JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXIII NO. 16 SAN FRANCISCO, OCTOBER 17, 1914 PER COPY, 25 CENTS

LIBRARY PERIODICAL

KEY CITY LIGHT AND POWER COMPANY.

A RESUME AND COMPARISON OF RATE THEORIES.
BY STACY HAMILTON.

STANDARDS AT SAN DIEGO.
BY L. M. KLAUBER.

ELECTRIC HEADLIGHTS.
BY A. G. JONES.

PATENTS A PROFITABLE FIELD.
BY GEORGE J. HENRY.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Supply Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

Diesel Engines
Busch-Sulzer Bros. Diesel Eng. Co.

Fixtures
Benjamin Electric Co.

Heating Appliances
Simplex Electric Heating Co.

Insulators
Hemingray Glass Co.
Pierson, Roeding & Co.

Lamp Standards
Pacific States Electric Co.

Lamps
Edison Mazda
National Mazda

Motors
Century Electric Co.
Crocker-Wheeler Co.
Wagner Electric Co.

Piping
Pittsburg Piping & Equipment Co.

Pole Line Hardware
Hubbard & Co.

Reduction Gears
Westinghouse Machine Co.

Switches
K. P. F. Switch Co.

Telephones
Western Electric Co.

Tools
M. Klein & Sons

Transportation
Southern Pacific Co.

Turbines
Pelton Water Wheel Co.

Wire (Trolley)
"Phono," Pierson, Roeding & Co.

Wire and Cable
Standard Underground Cable Co.
The Okonite Co.

Alphabetical Index to Advertisers, Page 8 **Where to Buy It in the West, Page 9**

Communities that would combine beauty and the artistic in their lighting systems, specify

UNION PRESSED STEEL LAMP STANDARDS

For street lighting Union Metal Lamp Standards are highly efficient as well as artistic.

because they are architecturally correct and harmonize perfectly with natural surroundings.

Are made of pressed steel and so constructed as to withstand the most heavy shock or jar without breaking.

Strongest, best and cheapest lamp standard made.

In residence parks lighting systems Union Metal Lamps Standards harmonize perfectly with the plans of the artist and engineer.

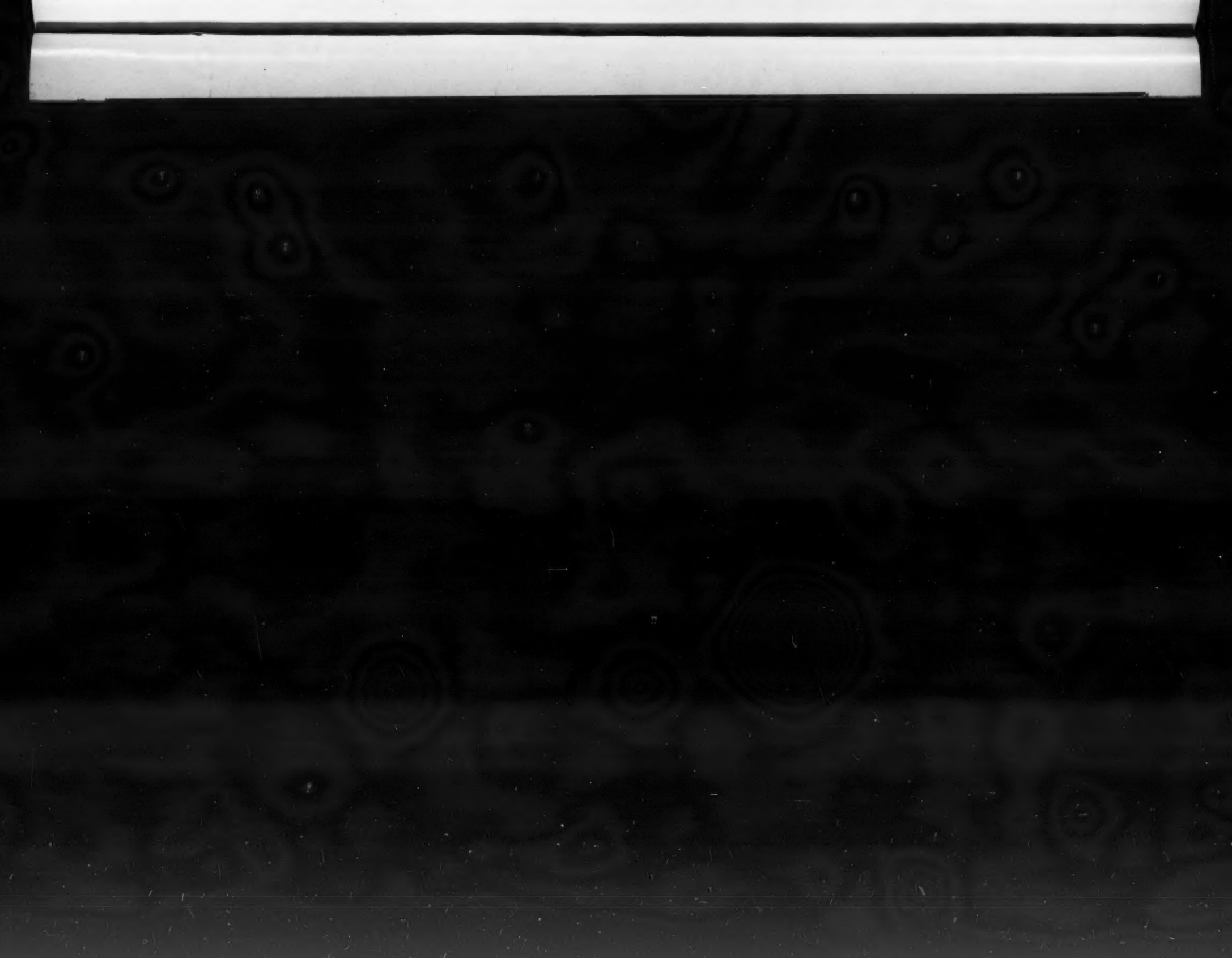
Our descriptive catalogue of designs on request

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

Distributors for the Pacific Coast

LOS ANGELES OAKLAND PORTLAND
SAN FRANCISCO SEATTLE



OCT 20 1914

©CLB309787

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXIII SAN FRANCISCO, OCTOBER 17, 1914 NUMBER 16

[COPYRIGHT 1914 BY TECHNICAL PUBLISHING COMPANY]

KEY CITY LIGHT AND POWER COMPANY

Coincident with the development of the great electric transmission networks of the West has been the gradual introduction of gas and electric service into smaller and more isolated communities, by independent companies. Typical of this class of company is the Key City Light & Power Company which serves the power and lighting needs of the thriving town of Port Townsend on Puget Sound, Washington, across the Strait of Juan de Fuca from Victoria, B. C.

At the Key City substation this power is stepped down to 2300 volts for local distribution by means of three 125 kw. oil cooled General Electric transformers. The switching equipment at this substation includes three 200 ampere, 66,000 volt automatic oil switches, one 66,000 volt Pacific Electric pole top switch with fuse, together with the usual lightning arrester and choke coil equipment, as well as proper switchboard apparatus.

Port Townsend, Washington.

The city of Port Townsend has an area of about nine square miles at the northeasterly end of the Olympic peninsula. Of this area about three square miles is served with electric current, the main supply being transmitted from the hydroelectric plant of the Olympic Power Company, the Key City Light & Power Company also having an auxiliary steam plant at Port Townsend. This company likewise furnishes gas to the town, which has a population of about 4000.

The Olympic Power Company operates two 6000 k.v.a. Westinghouse generators driven by 9600 h.p. turbines at a hydroelectric plant in Elwha Canyon, seven miles from Port Angeles, Washington. This power is transmitted at 66,000 volts over a hundred miles of line to various consumers, including the municipal plant at Port Angeles, the navy yard at Bremerton, the Key City company at Port Townsend, and Hood's Canal.

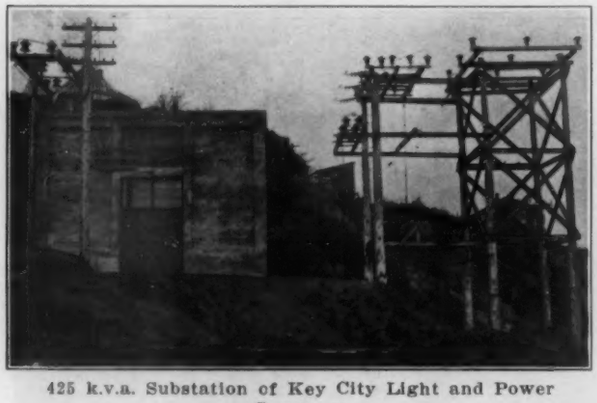
The auxiliary steam plant, which was the chief source of supply before the hydroelectric plant was completed, has two 2300 volt a.c. generators, one a 90 kw. Stanley and the other a 50 kw. General Electric machine driven by reciprocating engines. Steam is furnished at 150 lb. pressure by a Geary and an Atlas water tube boiler equipped for oil or wood firing, having a total rating of 325 h.p. The 80 kw. machine is direct connected to a McEwen compound engine, and the 50 kw. generator is belt driven from a 9 by 12 in. Ball engine.

Electric distribution is at 220 volts a.c., there being 15.75 miles of pole line. Lighting service is supplied at 115 volts and motor service at 220 volts. The average length of pole line per customer served is 175.7 ft.; 231.5 ft. being the average per residence consumer. A part of the town is served by 45 ft. poles used jointly with the Citizens' Independent Telephone

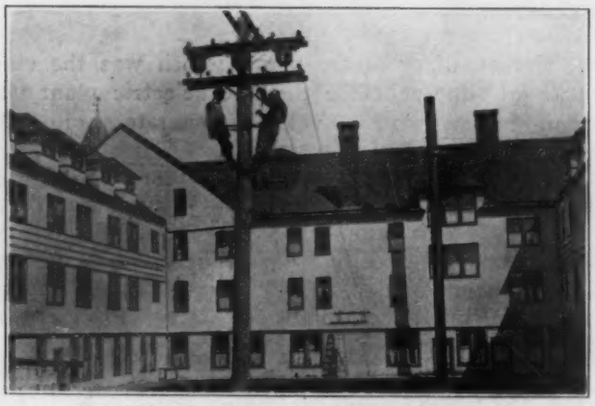
Company. The upper 7 ft. are used by the power company.

An interesting feature in connection with distribution line practice is the use of a portable derrick for raising and resetting poles. By this rig it is possible for two men to quickly handle 40 and 45 ft. poles at a minimum expense. One section of line 1.25 miles in length was constructed at a cost of $436.60 per mile; including the stringing of wires. The poles were 35 ft. in length, 50 in number, and spaced 130 ft. The ground was hard pan. The cross arms were 3 by 4½ by 8 ft., equipped with Pierce pins and Thomas insulators. Another .69 mile section cost $378.50 per mile, the ground being loose gravel and sand. The derrick is equipped with detachable wheels on which it is hauled from place to place by hitching to a wagon.

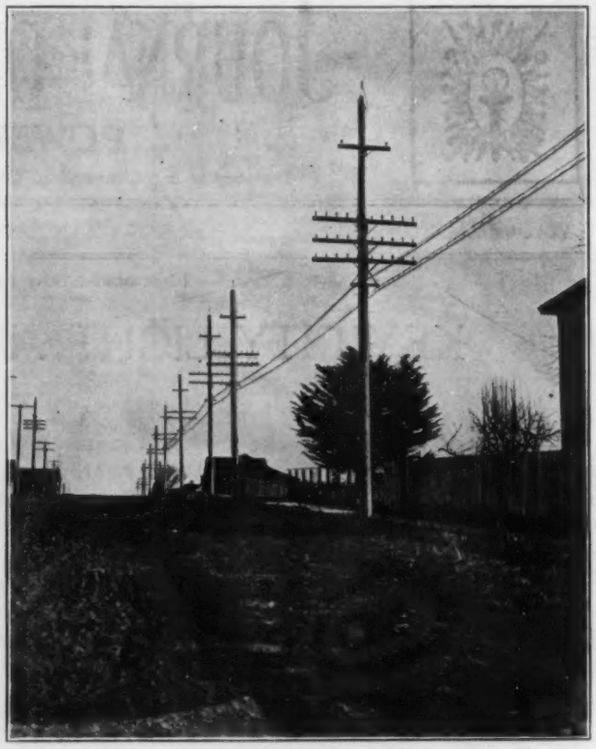
12,000 k.v.a. Hydroelectric Plant of Olympic Power Company.



425 k.v.a. Substation of Key City Light and Power Company.



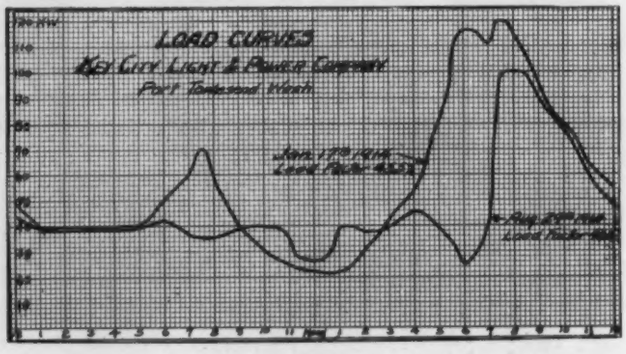
Pole Equipment Serving Cliff Lodge Hotel.



Joint Power and Telephone Pole Line.

There are 13½ miles of street lighting circuit, most of the lighting being by means of series 80 c.p. nitrogen filled Mazda lamps, mounted on brackets and fitted with reflectors. There are also seven 6.6 ampere flaming arc lamps, all-night lighting service being provided.

The company is serving 485 electric consumers, there being 13 motors of 1 h.p. or more having an aggregate load of 58 h.p. More than three-fourths of the residence consumers have electric irons and other appliances, as is well indicated by the load curve in-



Load Curve Showing Off-Peak Business Secured in 3½ Years.

crease during the past 3½ years. The rates scale down from 10 cents per kw.-hr., with $1 monthly minimum. Receipts of $7.93 per capita were obtained during 1913. For most of the information presented the writer is indebted to J. M. Kincaid, secretary and general manager of the company.

A RESUME AND COMPARISON OF RATE THEORIES,

BY STACY HAMILTON.

(This paper discusses some of the good and bad features of various rate theories and schedules, particularly as interpreted in the light of Commission decisions. It was presented at the Spokane meeting of the N. W. Electric Light & Power Association, The author is connected with the Portland Railway, Light & Power Company.—The Editor.)

This paper has been confined to electric light and power rates as being of most interest to this meeting. The writer is not undertaking to introduce any new theories as a general panacea for the innumerable

Key City Light & Power Company's Gas Works.

rate problems, but rather to discuss some of the good and bad features of the various rate theories and rate schedule forms now in use and to give some references to Court and Commission decisions having direct bearing on the points discussed.

The general subject of rates may well be divided into two general divisions, the first being devoted to a discussion of the revenue which a utility is entitled to derive from its investment and activities, and the second division dealing with the various methods in which the predetermined revenue may be obtained from the different classes of service rendered.

The determination of the permissible revenue involves, of course, the problem of fixing upon a fair valuation of the property both tangible and intangible, and a fair rate of return on the investment.

It is, however, with the second division only of the rate subject that this paper is to deal. The problems here presented are those arising after the valuation and a fair return on the investment have been determined.

Let us assume, for example, that a property devoted exclusively to the manufacture and distribution of electric light, power and heat, has been valued at $1,000,000, after due consideration of all the factors which enter into the proper determination of the value as a basis for the rates. Let us assume that 10 per cent has been determined as a fair return on the investment over and above operating expenses, including maintenance and depreciation, which we will assume have been shown to be $80,000 per year.

The gross revenue of this company should then be $100,000 per annum to cover interest charges and profit, plus $80,000 per annum to cover operating expenses, maintenance and depreciation, or a total gross revenue of $180,000. This, then, is the revenue which this company is entitled to earn (if it can) with an equipment and organization valued at $1,000,000.

This brings us to the second devision of the rate problem. The question now arises—What is the most equitable, practicable, and mutually satisfactory way in which this $180,000 per year can be apportioned among the various sources of this company's revenue.

The apportionment of the revenue among the various classes of service is naturally influenced to a certain extent by the schedules which are offered for each class, and, in the establishment of a system of rates, it is of no small importance to select a form of

Portable Derrick for Raising and Setting Poles.

rate for each class, which, in addition to being fair and equitable, will also encourage the greatest profitable development of the business of that class. For example, simplicity in expression is an important requisite, especially in residence rates. Again, in the case of power business, some form of load factor discount is of importance in order that the charge may automatically adjust itself to properly compete with other forms of power.

Those central stations which have been through the experience of making changes in the form of their rate schedules, appreciate the importance of minimizing these changes as much as possible by a very careful consideration of the form and other details of a rate schedule before it is put into effect. Under the present day regulation and close scrutiny of public utility rates, any central station, no matter how justified it may be, will experience considerable difficulty

in making a revision which will result in an increase for even a few individuals, even though the revision, as a whole, may be a reduction in the company's revenue. Changes in the form of rates will quite often more or less increase certain individual consumers, and the objections raised by these comparatively few consumers through the newspapers and otherwise, are apt to give the impression to the average citizen of the community that the change in the rates represents a general increase rather than an exceptional increase. Under these circumstances, the central station not only receives no credit for its general reduction, but is often subjected to considerable unfavorable criticism.

The usual result, therefore, in making a change in a rate, is a material decrease in revenue, even though the management only desires to change the form. It is, therefore, of the utmost importance that careful consideration of all phases be given so that future changes may not be found necessary.

There tends to be more or less of a diversity of interest between the company and its consumers in the determination of the amount of gross revenue which the company is to be allowed to receive for its services as a whole. Such diversity of interest, however, does not, or should not, exist, in the establishment of the various schedules which are to apply in giving the company its agreed upon revenue.

From the consumer's standpoint, first of all, good service is the prime requisite. This being accomplished, it is reasonable to assume that the consumers as a whole are best satisfied when the system of rate schedules, for the various classes of service, results in a charge for each class as nearly as possible in proportion to what the service is worth to that class. Such a system of rates will naturally tend toward the greatest possible development of the use of the central stations' service. This, in turn, results in a lower unit cost of rendering the service, which, in its turn, makes possible a further increase in net revenue for the company and a reduction in rates for the consumer.

It is readily seen that the central station's interests in this respect are identical with those of the consumer, i. e., it is of mutual interest to have a system of rates which will be most acceptable to the various classes, and which will tend toward the greatest development of the company's business. If there is no unwarrantable discrimination between classes, with the resultant dissatisfaction of the class discriminated against, it makes little or no difference to the central station how the revenue is divided between the classes, providing the rates are acceptable to the consumers as a whole, and also providing that they insure a total revenue sufficient to make the enterprise reasonably profitable.

There are two general basic theories on which a system of rates may be established, i. e., the cost of service theory and the value of service theory.

Cost of Service Theory.

The cost of service theory, as its name implies, aims to charge each individual consumer directly in proportion to the cost of serving that consumer. Such a basis would seem to be the most equitable and proper for the charges of any public utility, and, theoretically, this is no doubt true. It is found, however, in the practical application of rates, that there are a number of other factors which must be considered.

Perhaps the most direct application of the cost of service theory is found in the differentials allowed for quantity, load factor, time and character of demand, minimum charge, etc. Even these differentials, however, are often governed to a certain extent by the value of the service to the consumer.

Owing to the multiplicity of factors entering into a determination of the exact cost of rendering service under varying conditions, it naturally follows that a certain amount of averaging must be resorted to for the sake of simplicity in the expression of the rate schedules. Under the cost of service theory we have, at one extreme, the attempt to differentiate in proportion to the exact cost to each individual condition of service. This must necessarily result in a schedule so complicated as to be entirely impracticable. At the other extreme we have a general average or uniform rate to all consumers based on the general average cost of rendering service to all consumers. Where the conditions of service and the cost of supplying service vary to a considerable extent, as they do in the case of electric light and power service, a general average rate per kw.-hr., per lamp, or per day, naturally results in a degree of inequity between individual consumers which the central station is unable to justify. Such an average rate would also tend to retard the development of the company's business, to the detriment of the community as well as to the company itself. Only in cases of complete monopoly have uniform rates been found to work out satisfactorily, the United States Postal charges being, perhaps, the best example of this form of rate. Even here it is to be noticed that in the Parcel Post division, which is in competition with the express companies, zone differentials are resorted to, the uniform flat rate applying principally to first class mail, where the government has an absolute monopoly, competition being prohibited by law.

As a compromise, therefore, between the extremes of the complexity of individual cost of service and the inequity of average cost of service, the trend of commission and court decisions seems to be toward averaging, more or less arbitrarily, the various classes of service, that is, basing the rates for each class on the average cost and average condition governing that class as a whole.

Value of Service Theory.

The value of service theory, as its name implies, contemplates the value of the service to the consumer as the proper basis on which the charges should be made. This basis has undoubtedly predominant influence in the establishment of prices in other lines of business, and it bears no small part in the consideration of the proper charges for electric light and power service as well.

This theory, of course, when carried to extremes, is quite apt to result in an unreasonable charge to those consumers who have no other alternative but to use the company's service at what ever rate may be demanded. Aside from this extreme condition, however, the value of service theory is a very important factor in establishing a proper schedule of

charges, especially in its influence toward the encouragement and development of the use of the central station's service.

In a consideration of the value of service theory, there are found to exist two general classes of business, usually termed competitive and non-competitive. This classification is, of course, under the assumption that the light and power utility has no direct competition from another utility of the same class.

Competitive Business.

In the competitive class, come first the large office buildings, hotels, factories, mills, and other large units which are in position to consider the installation of an independent electric plant. The value of the central station's service to such consumers is necessarily governed by the cost at which the consumer can furnish electric service from a plant of his own. We also have, in the competitive class, those consumers who can use steam or gas engines for power, and gas, oil, etc., for lighting.

The latter forms of competition are not quite so direct as the independent electric plant first mentioned, inasmuch as they do not always completely replace the value of the central station's electric service to the consumer. Under these conditions, the cost to the consumer to furnish his own service by means of these various substitutes does not quite so directly control the value of the central station's service to the consumer and consequently the central station's rate necessary to get the business.

Non-Competitive Business.

The strictly non-competitive consumers of an electric light, power and heat utility are decidedly scarce, as there are very few requirements of light, power and heat, which cannot, in the event of unreasonable electric rates, be filled in some other form. The commercial department of any electric utility is well aware, even though it has no direct electric competition, that its business is far from being a monopoly, as is popularly supposed. There are, however, undoubtedly a number of consumers to whom electric service is of such additional value in furnishing light, power and heat, that they are willing and able to pay a rate considerably higher than the other forms of service would cost. Theatres are perhaps the best example of this class.

Numerous non-competitive conditions can be found outside of the electric light, heat and power utilities, such as in the case of water supply, transportation, and last but not least, the United States Postal Service, in the latter case competition being strictly prohibited by law.

In the establishment of a schedule of electric rates for these various non-competitive and competitive consumers, we have, in the first case, the limitation that the rate charged to the strictly non-competitive consumer must be reasonable and be governed by the cost of serving such a consumer. In the second case, the rates offered to the large competitive consumer should be at least sufficiently high to pay something more than the direct additional cost of serving such a consumer, or the increment cost, as it is sometimes termed.

Differentials to Meet Competition.

There seems to be a diversity of opinion as to the equity of charging these large competitive consumers less than their full pro rata of the total cost of serving them, including all fixed charges. It is contended by the opponents of this method of charging that it discriminates against the non-competitive consumers, inasmuch as they must necessarily be charged more than their pro rata of the cost of service to compensate for the low rates which must be made to the competitive consumers to get the business.

The fact remains, however, that if this principle were not applied, a large amount of competitive business could not be obtained, with the result that the non-competitive consumers would be obliged to carry the entire burden of that large portion of the fixed charges and operating expenses which remain practically constant, regardless of whether or not the additional competitive business is on the system.

In the case of railway rates, this principle has been established for a number of years in the form of the so-called "Pacific Coast Terminals Rates" designed principally to compete with water transportation. Even after the adjustments now contemplated by the Interstate Commerce Commission and the United States Supreme Court have been effected, this principle will continue in a modified form.

Feature Rates.

The value of service theory is often quite prominent in the classification of the various forms of service.

Most central stations usually have one or more so-called feature rates, which have, as their object, the development of electric service along certain lines, such as cooking, heating, and various forms of domestic power.

With the present state of development of electric cooking and heating appliances, it is evident that a given quantity of electric energy, when used for cooking and heating, has not as high a value to the consumer as when used for lighting with the modern high efficiency lamps. In recognition of this fact, we have the low rates of 5c, 4c, 3c and so on down to the one cent rate which has been offered by some English companies, aiming towards the encouragement of the domestic use of electric energy for cooking, heating and power purposes, while at the same time, a materially higher rate exists for lighting service.

There may be some attempt to defend this differential from the "cost to serve" standpoint, on the ground that cooking and heating are off-peak loads. If special circuits are run for this class of load exclusively, and the service is actually cut off during the station's peak, a considerable differential between lighting and heating can, no doubt, be justified, purely from the "cost to serve" standpoint. In actual practice, however, cooking and heating services on this special rate are quite often taken from the lighting mains, and, while more or less of the domestic cooking and heating consumption of energy will perhaps occur during the off-peak period, the fact remains that when service is rendered under the condition just mentioned, (which is quite common among central sta-

tions) a large part of the maximum demand of the cooking and heating appliances will often come directly on the central station's winter peak, between 4:30 p. m. and 6:00 p. m. Under these conditions the differential can hardly be based on other than the value of service theory.

A similar condition exists in other forms of lighting and power feature rates, that is, the value of service is practically the only valid reason for the differential in the rates charged for two or more classes of service furnished under practically identical conditions. A good example is the lower rate for power service furnished from underground direct current systems, where the power and light are delivered from the same mains and through the same service cables.

In calling attention to these conditions it is by no means the intention to infer that such a differential should not exist. It is quite evident that attractive prices must be offered for certain forms of heat and power, especially during the development stage, in competition with other forms of furnishing the required heat and power.

Outside the electric industry, a very good example of the value of service theory is shown in the rates charged for Pullman berths. The investment in an upper berth is considerably higher than in the equipment necessary to convert the seats into a lower berth, and, on the cost of service basis, would call for a higher charge than the lower berth. In practice, however, the desirability or value of the lower berth to the traveling public is so much greater than the upper berth, that the rates have been made approximately 20 per cent lower for the upper berth. This differential in the price of the upper and lower berths was ordered by the Interstate Commerce Commission (20 I. C. Reports, 21 to 32).

The attitude of various Commissions and Courts toward the value of service theory may be found expressed in the following:

Interstate Commerce Commission.

"Railway Rate Theories of Interstate Commerce Commission," by M. B. Hammond, pages 181, 182, 186, 187, 529.

Massachusetts Board of Gas and Electric Light Commissioners.

Massachusetts Gas and Electric Reports 1909—33, 42 to 47.
Massachusetts Gas and Electric Reports 1910—20, 50, 51.
Massachusetts Gas and Electric Reports 1911—29, 30.
Decision 6/7/1913 re Marblehead Municipal Plant's application to reduce rates.
Decision 5/24/1913 re Westfield Municipal Plant's application to reduce rates.
Decision 7/28/1913 re complaint against Edison Electric Illuminating Company of Brockton, Mass.

Michigan Statutes.

Public Acts 1909, No. 106, Sec. 7.

California Railroad Commission.

Town of Willets vs. Willets Water & Power Company, Case, No. 297.

New York Public Service Commission, 2nd District.

Decision 4/2/1913 in re Complaint of Mayor of Buffalo vs. Buffalo General Electric Company.

Supreme Court of New Jersey.

Decision 7/7/1913, Public Service Gas Company vs. New Jersey Board of Public Utility Commissioners, 87 Atlantic 651.

Wisconsin Railroad Commission.

City of Beloit, 1910, 5 W. R. C. R. 632.
Ripon Light and Water Company, 1910, 5 W. R. C. R. 45.
Decision 11/14/1913 re Application of Neshkoro Light and Power Company to increase rates.
Decision 8/4/1913 re Complaint against Milwaukee Gas Light Company.

It is therefore seen that while the cost of service is, perhaps, theoretically the most proper and equitable basis on which to establish the central station's charges, and is generally accepted as the primary basis of rate schedules, such a basis must often be considerably modified, not only for the sake of simplicity in the expression of the schedules, but also by the commercial and economic considerations of the value of the service and the development of the business.

Various public utility commissions, courts and other authorities give recognition to both these theories, and the general trend of opinion and decisions seems to be towards the cost of service as a primary basis of rates, modified, however, by the value of service theory.

Individual rates in a system of charges may sometimes fall entirely under one of these theories, to the complete exclusion of the other theory. The differential between the upper and lower Pullman berth rates is such a case, the cost of the service being entirely ignored in the establishment of the differential.

At the other extreme, we may cite, as an example, strictly off-peak rates which are offered for any form of use which the consumer may desire.

These are rather extreme cases, however, and an analysis of the rate schedules of almost any central station will indicate that both theories are usually taken into consideration.

A brief discussion of the various forms of rates now used by central stations is pertinent to the subject. The Rate Research Committee of the National Electric Light Association has devoted no small part of its efforts towards the standardization of the form of rate schedules, and a step in this direction is a consideration of the advantages and disadvantages of the various forms of rates.

The writer has in mind the following nine distinct types of rate forms which will be briefly discussed:

No. 1. Flat Rate.

The chief objection to this form of rate is the waste of energy which is quite apt to occur, especially in the case of lighting loads, and its consequent effect not only on the operating costs (where a large part of the generation is by steam), but also on the diversity factor. In the case of lighting rates, the waste may be checked to some extent by requiring the consumers to use Mazda lamps and furnish their own lamp renewals. With the constantly decreasing price of lamps, however, and the increasing useful life, this can hardly be expected to act as a sufficient incentive to the average consumer to be economical in the use of the service on a flat rate basis. Such a rate is often far from the cost of rendering service to the individual and must necessarily be a more or less inequitable average price. If not confined to a rather narrow range of operating conditions or class of consumers, an average flat rate will have a tendency to retard the development of the use of the central station's service, as it will often be too high to obtain business which can be carried profitably on a rate lower than the average.

For example, the central station may have in effect a load factor rate or some other differential form of rate for residences which would result in a low rate for heating and cooking appliances. The average revenue derived from this rate might be 10 cents per kilowatt hour. If the company replaced such a rate with a straight rate of 10 cents per kilowatt hour the

future development of the heating and cooking load would be considerably handicapped.

First among the advantages of a flat rate is the simplicity of expression, which is always desirable, especially for residences. Such a rate is perfectly satisfactory where the company has control of the service, as, under this condition, the amount of service rendered and consequently its cost and value, can be definitely determined. Municipal street lighting is, perhaps, the best example of this. Similar service is rendered for sign lighting, show window lighting, etc. For the latter purpose a flat rate of so much per lamp per month is a very good way to insure a good load factor and a proper maintenance of the lamps, as a flat rate charge can, of course, be made to include long hour burning and proper maintenance by the company. The maintenance feature is usually desirable to the consumer, especially when there is an accident risk involved in renewing the lamps. Another big advantage of such a rate is that it does away with all meter expense, which is a very large item in small residence lighting, including, as it does, investment and depreciation charges on the meter, periodical calibration, and reading. The meter expense alone may represent 25 per cent of the total cost of serving a small residence consumer.

A flat rate also makes practical the collection for service in advance, as is often done by telephone and water companies. In dealing with some classes of consumers, this is a decided advantage in avoiding credit risks, and where large amounts are involved the interest item alone for the current month is of no small consequence.

The unit taken in making a flat rate charge is rather immaterial, provided it is something definite and tangible that the consumer can readily understand. So much per lamp, or other unit of equipment, is perhaps the best. The schedule covering different size units can, however, be considerably simplified by charging so much per watt. The present practice of designating lamps in terms of watts rather than candlepower, as formerly, has resulted in the wattage basis being generally understood by all classes of consumers.

Perhaps the most notable use of flat rates for uncontrolled service is in Hartford, Connecticut, where the Hartford Electric Light Company has for some time successfully served a large number of small residence consumers on the basis of so much per lamp per month, the only requirement being that Mazda lamps be used. This company, however, recommends that service of this nature be limited only to the smallest consumers, where the meter expense would be almost, if not altogether, prohibitive.

Following are some references to opinions on flat rate charges:

Wisconsin Railroad Commission.

Ripon Light and Water Company, 1910, 5 W. R. C. R. 34.
Durand Light and Power Company, 1910, 6 W. R. C. R. 334-348.
City of Rhinelander vs. Rhinelander Lighting Company, 9 W. R. C. R. 406.

District Court, Eastern District of Idaho.

City of Pocatello vs. Murray et al., 5/16/1913, 206 Fed. 72.

No. 2. Straight Meter Rate.

The chief argument against this rate is that it is not proportional to cost, and, like the flat rate per unit of equipment, has the disadvantage of any rate which strikes a general average. A differential for quantity will, however, considerably improve such a rate for application to a class of load with comparatively narrow range of individual demand. Compared with the flat rate per unit of equipment, it has the disadvantage of requiring an investment in and operation of meters.

Simplicity stands perhaps first in the advantages of this form of rate. Also, on a meter basis, unnecessary waste is prevented. With a proper differential for quantity, and a suitable minimum charge, such a rate is very satisfactory for residence business, as the individual demands of this class of load are between such narrow limits, and the diversity factor is usually so high, that a differential for demand is hardly necessary, and only serves to confuse and irritate the consumer.

Following are some references to opinions on straight meter rates:

Wisconsin Railroad Commission.

Ripon Light and Water Company, 1910, 5 W. R. C. R. 34.
Red Cedar Valley Electric Company, 1911, 6 W. R. C. R. 717, 758, 759.

Massachusetts Board of Gas & Electric Light Commissioners.

Edison Electric Illuminating Company of Boston, Mass. G. &. E. R., 1909, 44, 45.

Arizona Corporation Commission.

Decision 7/9/1913 Establishing Straight Meter Rates for Tucson Gas, Electric Light and Power Company.

Montana Public Service Commission.

Decision 11/3/1913 Establishing Straight Meter Rates for Helena Light and Railway Company.

Georgia Railroad Commission.

Decision 2/24/1914 Establishing Straight Meter Rates for Macon Railway and Light Company.

Illinois Public Utilities Commission.

Decision 5/6/1914 Approving Straight Meter Rates for Western United Gas & Electric Company.

No. 3. Straight Demand Rate.

By a straight demand rate is meant a rate of so much per kilowatt or other unit of demand per year, or per month. Such a rate has practically all the advantages and disadvantages of the previously mentioned flat rate, with the difference, however, that, being based on the actual demand, it comes nearer to being proportionate to the cost of service than does a rate based on the unit of equipment, or, in other words, on the connected load. Such a rate has the advantage of being simple in expression, making possible advance collections, and enabling the consumer to know definitely, in advance, the cost of the service to him. This is often desirable, especially in contracting work. Such a rate can, and is often applied advantageously to irrigation, as the demand requirements can usually be quite definitely ascertained in advance, as well as the operating conditions, such as load factor and time of peak. As with the flat rate, the kilowatt hour meter expense is also eliminated.

[To be continued.]

Electrical resistance ceases at the absolute zero, as has recently been experimentally proven by Prof. K. Omnes, who has produced a temperature of 271.8 degrees below zero Centegrade by the rapid evaporation of liquid helium. A coil of one thousand turns of fine insulated lead wire with terminals joined was immersed in a bath of liquid helium placed between the poles of an electromagnet. The removal of the magnet induced ½ ampere in the coil, the current continuing to flow as long as the coil is kept in the liquid helium.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

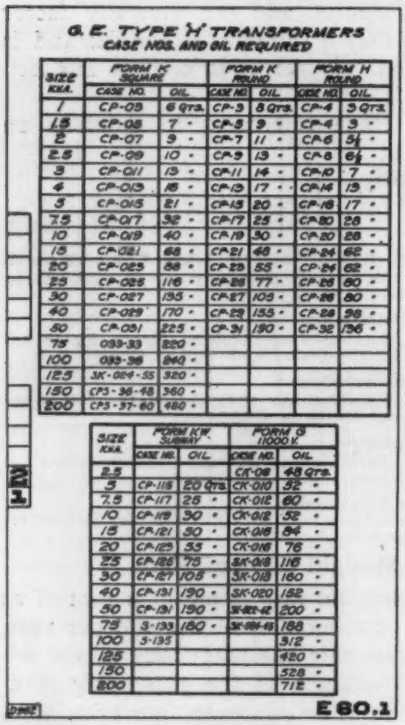
D. Overhead Construction.

BY L. M. KLAUBER.

[Continued.]

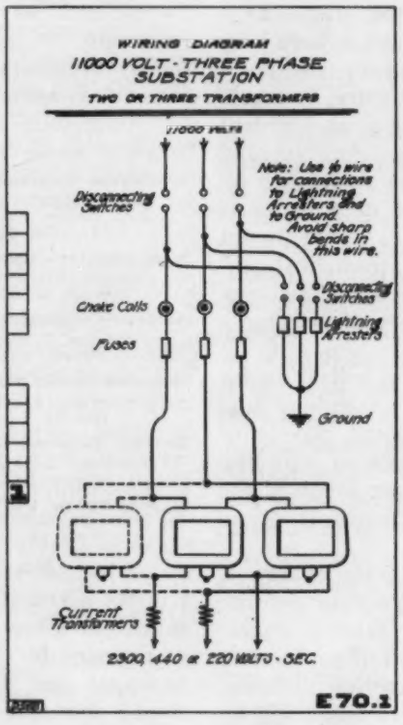
E 50, E 60: Weights, Case and Oil Data. This information is approximate only and is inserted for the assistance of storeroom and yard men in making up truck loads.

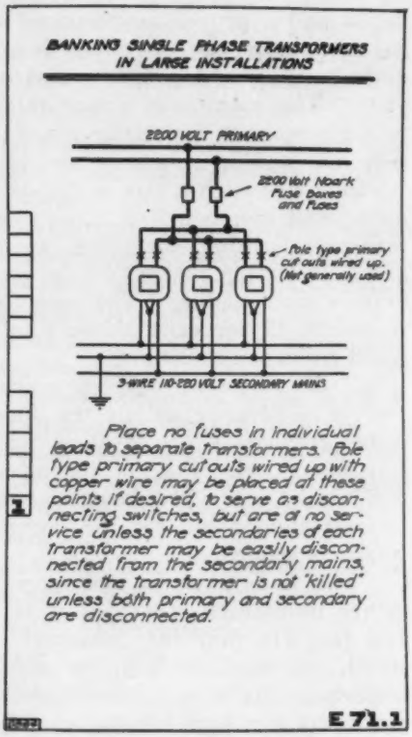
E 70: Wiring Diagrams. These, covering substations, banks and boosters, conclude the information on transformers. Only a few of the many possible booster connections are shown, as it is deemed better to accompany each work order with diagrams where special connections are required.

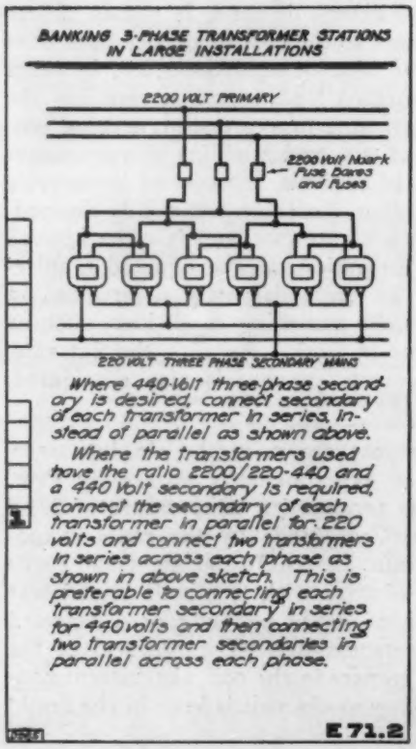


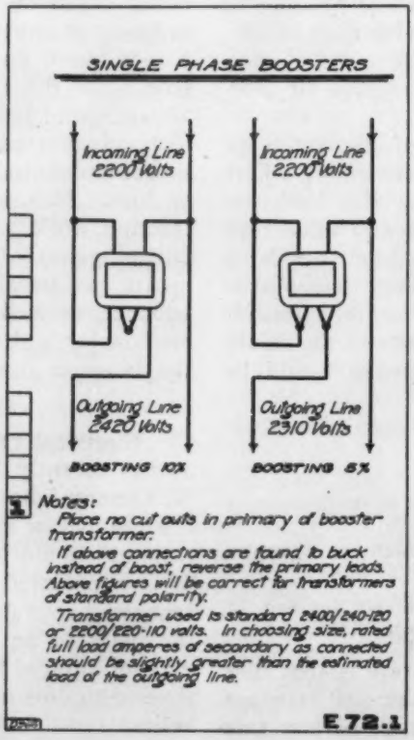
SIZE KVA.	FORM K SQUARE CASE NO.	FORM K SQUARE OIL	FORM K ROUND CASE NO.	FORM K ROUND OIL	FORM H ROUND CASE NO.	FORM H ROUND OIL
1	CP-03	6 Qts.	CP-3	8 Qts.	CP-4	3 Qts.
1.5	CP-05	7 "	CP-5	9 "	CP-4	3 "
2	CP-07	9 "	CP-7	11 "	CP-6	5½ "
2.5	CP-09	10 "	CP-9	13 "	CP-6	6½ "
3	CP-011	15 "	CP-11	14 "	CP-10	7 "
4	CP-013	16 "	CP-13	17 "	CP-14	15 "
5	CP-015	21 "	CP-15	20 "	CP-16	17 "
7.5	CP-017	32 "	CP-17	25 "	CP-20	28 "
10	CP-019	40 "	CP-19	30 "	CP-20	28 "
15	CP-021	68 "	CP-21	48 "	CP-24	62 "
20	CP-025	88 "	CP-25	55 "	CP-24	62 "
25	CP-026	116 "	CP-26	77 "	CP-28	80 "
30	CP-027	135 "	CP-27	105 "	CP-28	80 "
40	CP-029	170 "	CP-29	155 "	CP-28	98 "
50	CP-031	225 "	CP-31	190 "	CP-32	156 "
75	033-33	320 "				
100	033-39	340 "				
125	3K-004-55	320 "				
150	CP3-36-48	360 "				
200	CP3-37-60	480 "				

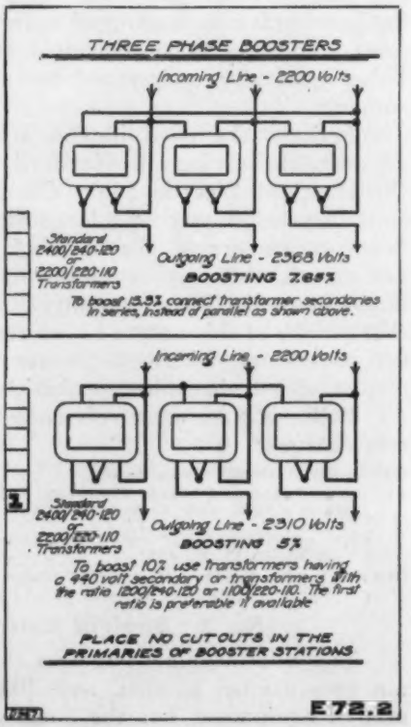
SIZE KVA.	FORM K.W. SUBWAY CASE NO.	FORM K.W. SUBWAY OIL	FORM S 11000 V. CASE NO.	FORM S 11000 V. OIL
2.5			CK-08	48 Qts.
5	CP-118	20 Qts.	CK-010	32 "
7.5	CP-117	28 "	CK-012	60 "
10	CP-119	30 "	CK-012	52 "
15	CP-121	50 "	CK-016	84 "
20	CP-125	55 "	CK-016	76 "
25	CP-126	75 "	3K-018	116 "
30	CP-127	105 "	3K-018	160 "
40	CP-131	190 "	3K-020	152 "
50	CP-131	190 "	3K-021-42	200 "
75	3-133	180 "	3K-019-48	188 "
100	3-135			312 "
125				420 "
150				528 "
200				712 "




BANKING SINGLE PHASE TRANSFORMERS IN LARGE INSTALLATIONS
2200 VOLT PRIMARY
2200 Volt Moark Fuse Boxes and Fuses
Pole type primary cut outs wired up. (Not generally used)
3-WIRE 110-220 VOLT SECONDARY MAINS
Place no fuses in individual leads to separate transformers. Pole type primary cut outs wired up with copper wire may be placed at these points if desired, to serve as disconnecting switches, but are of no service unless the secondaries of each transformer may be easily disconnected from the secondary mains, since the transformer is not "killed" unless both primary and secondary are disconnected.
E 71.1


BANKING 3-PHASE TRANSFORMER STATIONS IN LARGE INSTALLATIONS
2200 VOLT PRIMARY
2200 Volt Moark Fuse Boxes and Fuses
220 VOLT THREE PHASE SECONDARY MAINS
Where 440-Volt three-phase secondary is desired, connect secondary of each transformer in series, instead of parallel as shown above.
Where the transformers used have the ratio 2200/220-440 and a 440 Volt secondary is required, connect the secondary of each transformer in parallel for 220 volts and connect two transformers in series across each phase as shown in above sketch. This is preferable to connecting each transformer secondary in series for 440 volts and then connecting two transformer secondaries in parallel across each phase.
E 71.2


SINGLE PHASE BOOSTERS
Incoming Line 2200 Volts
Incoming Line 2200 Volts
Outgoing Line 2420 Volts
Outgoing Line 2310 Volts
BOOSTING 10%
BOOSTING 5%
Notes:
Place no cut outs in primary of booster transformer.
If above connections are found to buck instead of boost, reverse the primary leads. Above figures will be correct for transformers of standard polarity.
Transformer used is standard 2400/240-120 or 2200/220-110 volts. In choosing size, rated full load amperes of secondary as connected should be slightly greater than the estimated load of the outgoing line.
E 72.1


THREE PHASE BOOSTERS
Incoming Line - 2200 Volts
Standard 2400/240-120 or 2200/220-110 Transformers
Outgoing Line - 2368 Volts
BOOSTING 7.65%
To boost 15.5% connect transformer secondaries in series, instead of parallel as shown above.
Incoming Line - 2200 Volts
Standard 2400/240-120 or 2200/220-110 Transformers
Outgoing Line - 2310 Volts
BOOSTING 5%
To boost 10% use transformers having a 440 volt secondary or transformers with the ratio 1200/240-120 or 1100/220-110. The first ratio is preferable if available
PLACE NO CUT OUTS IN THE PRIMARIES OF BOOSTER STATIONS
E 72.2

ELECTRIC HEADLIGHTS.

BY A. G. JONES.

(The factors leading up to the use of the nitrogen filled lamp for locomtive headlight use are thoroughly discussed by the author who was largely instrumental in the adoption of this form of headlight in Nevada. This paper was presented at the meeting of the Nevada Industrial Safety Association on September 7, 1914.—The Editor.)

Modern engineering, be it electrical, mechanical, mine or any other other phase, is embracing a steadily increasing factor; namely—safety. Anything which tends to reduce accidents is largely investigated and utilized, if possible, in modern practice. One of the most effective safety tools is light.

The advance of the art of the production of artificial light has been very rapid during the past few years. New forms of illuminants have been invented and wonderful improvements made in old types. Of the latter the incandescent lamp stands unquestionably at the head. It was but a few years ago that the 16 candlepower carbon lamp, consuming 56 watts of power, was practically the only incandescent lamp available in commercial quantities. Today we have the tungsten filament Mazda lamp in units of from ½ to 2000 candlepower. This range allows of application to practically all fields of human activity. Some of these lamps, consuming but 8 watts, instead of 56, for every 16 candlepower emitted, together with the steadily decreasing cost of power, allow the use of a profusion of light for all operations. This has resulted in the prevention of many, many accidents, particularly around moving machinery and in the various industries. The hazards of mining, for example, are being reduced by lighting the mines with Mazda lamps. Small candlepower lamps are replacing the old oil lamps, enormously reducing the possibility of explosion; large lamps being used to light the shafts and galleries.

With the large increase in possible applications of Mazda lamps there arose a new science; that of illuminating engineering, or the study of the production and application of light. This study has developed many new fields and new methods for old fields. Not the least important of these is that of headlights. Ever since the history of transportation began, headlights have been in use. One of the first consisted of a pile of burning pine knots pushed on a flat car in front of the locomotive.

A headlight has three important functions: First, to act as a marker on the front end of a train, warning people of the train's approach; second, to show up obstructions on the track in time to allow an engineer to reduce speed sufficiently to avert a serious accident and third, to enable an engineer to distinguish signals and other markers. The first and third require a headlight of fairly low intensity, while the second favors the use of a very powerful headlight. There is much controversy between both practical railroad men and also the theorists as to which type is better. The opponents of the powerful headlight claim that it so blinds an engineer on an opposing locomotive that he is temporarily unable to read his signals; the glaring light may so blind train men and other pedestrians around railroad yards as to completely bewilder them, often resulting in serious accidents; that under certain conditions the glaring light thrown by a powerful headlight produces phantom signals; i. e., gives a signal the appearance of being lighted when it is not, distorts its true color, etc., by reflecting of the beam of light from the headlight. On the other hand, it is claimed a powerful headlight prevents many a collision, enables the "picking up" of distant objects, land marks, etc.

Various laws have been passed by the states to regulate this question. One state requires 300 watts at the arc; while others specify the size of the reflector. Twenty-eight states have enacted laws on the headlight subject. The wide discrepancy of these laws makes it almost impossible for a railroad doing interstate business to comply with them all. These conflicting laws have caused considerable trouble and

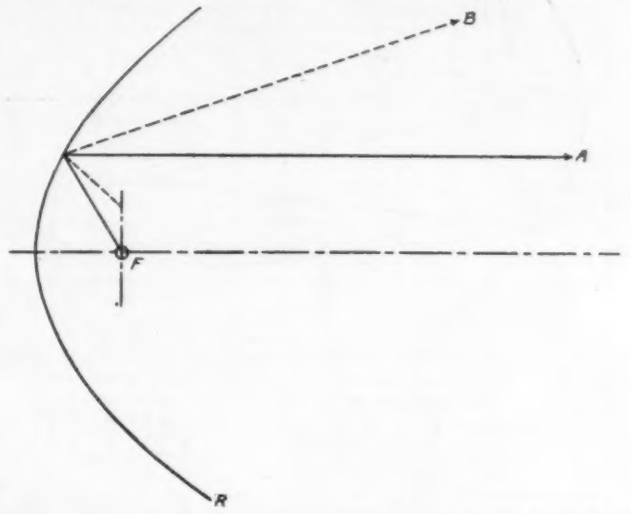


Fig. 1. Illustration of Parallel Reflection of Light Ray Originating at Focus and of Diverging Ray Originating Outside of Focus of Parabolic Reflector.
R=parabolic reflector.
A=ray originating at F.
F=focus of R.
B=ray originating outside.

there is now before Congress a bill instructing the Interstate Commerce Commission to investigate the subject.

Researches have been carried on independently, by various railroads, from which it seems that a headlight of intermediate power; i. e., more powerful than the oil, yet not so dazzling as the arc, would be advantageous. Such a headlight was offered by the incandescent lamp. With these lamps as a light source, a wide range of headlights is possible by using various sized lamps.

It is only recently that strong incandescent headlights have become practical, due to the drawn-wire Mazda lamp. By the use of drawn-wire the filament of the lamp can be wound into a very closely coiled spiral, thus enabling the light to be concentrated around the focus of the lens or reflector used in the headlight. This concentration is necessary to produce a beam of light. All light originating at the focal point of a parabolic reflector will be reflected parallel to the axis of the lamp, as ray "A" in Fig. 1, while if the light originates outside the focus it will be scattered, as ray "B"; the degree of its divergence depending upon the degree of concentration of the light source. As it is impractical to make an actual point source of light, the beam of a headlight must

necessarily diverge. In reality it consists of an infinite number of cones of light, "A," "B," etc. (See Fig. 2), the resultant beam being somewhat as indicated in Fig. 3. Taking each individual cone it may be considered as originating practically at a point, and as a whole beam is a sum of these cones at such a distance that the diameter of the headlight is negligible compared to the distance, the whole headlight may be considered as a point source of light and the intensity of beam, therefore, will vary inversely as

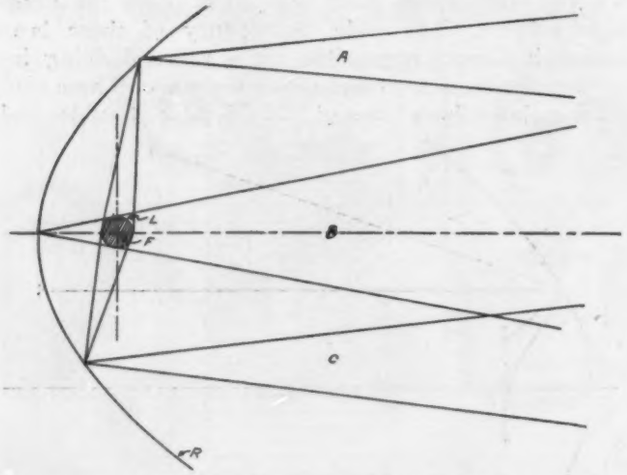


Fig. 2. Cones of Light From Spherical Light Source in Parabolic Reflector.

L=Light source.
F=focus of R.
R=parabolic reflector.
A, B, C=light cones.

the square of the distance from the headlight. This means that if a man 100 feet ahead of the light is illuminated to a certain intensity, he would receive but one-fourth this intensity if 200 feet away. Objects are seen by reflected light, which would also vary inversely as the square of the distance; hence, to show up an object equally well at 200 feet as 100 would require a headlight of sixteen times the power.*

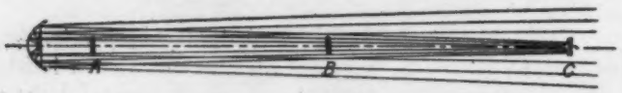


Fig. 3. Diagram Illustrating Measurement of Intensity of Light From Searchlight.

The question of "pick-up" distance of a headlight depends not only upon the candlepower of the headlight beam, but also upon the contrast between the object and the background against which it is viewed and also upon the amount of light shining directly in the observer's eye. Tests by various railroads seem to indicate that a man in white can be discerned against a dark background about 1 6/10 times as far as one in grey, and one in grey about 1 3/10 as far as one in black. These tests also indicate that from 5/100 to 1/10 foot candle intensity is necessary to show up a man in dark clothes at a distance of 1000 feet. Knowing that light varies inversely as the square of the distance, one can see this means a headlight $.05 \times (1000)^2 = 50{,}000$ beam candlepower.

*Statement by D. F. Crawford, P. R. R. in Bulletin No. 58—Special Committee on Relation of Railway Operation to Legislation—P 3-8 L-31.

The ordinary oil lamp has a beam candlepower of about 800-1000, while that of the arc headlight may run as high as 1,000,000. Between these come the incandescent headlights which can be made of almost any candlepower desired. The incandescent lamps used in these headlights are low voltage lamps for two reasons; first, because a low voltage filament can be concentrated into a smaller space than a high voltage, due to the long wire necessary to obtain the proper resistance for the latter; and, second, to obtain greater mechanical strength. Six volt lamps are made of 51, 106 and 166 candlepower. Tests by the Southern Pacific Railroad have shown that with a 6 volt lamp of 140 candlepower, in a 20-inch parabolic reflector of 2/34 inch focus, a man in dark clothes could be picked up 1800 ft. ahead of the locomotive. Six volt headlight lamps are being operated by storage batteries, and there are also under construction a number of 6 volt turbo generator outfits for this purpose. Where 34 volt outfits, in common use with arc headlights, are already in service, 34 volt incandescent lamps are available. As the filament is not so concentrated in these, the beam has greater spread and is considerably less powerful for equal wattage consumption.

The question of spread is another one which enters in as well as the maximum intensity of a beam. How shall a headlight be rated? If it is rated in pick-up distance, no two calculations are liable to be exactly duplicates. If it is rated in beam candlepower, or what is the same thing—its ability to deliver a certain foot candle intensity at a certain definite distance—it may have very little spread i. e., it may be but a pencil of light obviously not sufficient for a good headlight. Probably a combination of the two will be the best; i. e., a rating giving the average beam candlepower over a definite angle, measured at 200 or more feet from the headlight.

Headlight beams are measured by placing the training the beam on a wall or other normal surface lamp exactly in focus (this is easily accomplished by at a distance of several hundred feet and adjusting the focusing device until the smallest spot of light is obtained on the wall) and then measuring the intensity with a portable photometer at a distance of several hundred feet. Foot candle readings are generally taken every foot across the beam on a plane passing through the center of the beam. These readings plotted give the illumination distribution curves of the headlight (Fig. 4.)

The performance is also frequently given in beam candlepower, which is obtained by averaging the values at corresponding distances from the center of the beam; i. e., the foot candles at 2 feet to the left and 2 feet to the right of the center, etc., and multiplying this figure by the square of the distance from the photometer to the headlight. This will give the beam candlepower and plotted, will appear as in Fig. 5. If the maximum candlepower of the beam is found to be 100,000 and the candlepower of the bare lamp itself is 100, the ratio of these two; i. e., 1000, is called the multiplying factor of the equipment.

The incandescent headlight has many advantages. Once the light source is located at the focus of the lens or reflector, it will remain there until the lamp

burns out. This produces a steady beam of good color, which will stay on the track. No attention is required, except the replacement of burned-out lamps. The headlight can be made air-tight, thus retaining a high polish on the reflector. Headlights can be very easily dimmed when approaching an opposing locomotive or when entering terminals; thus the incandescent headlight is simple in construction, installation and maintenance, also reliable.

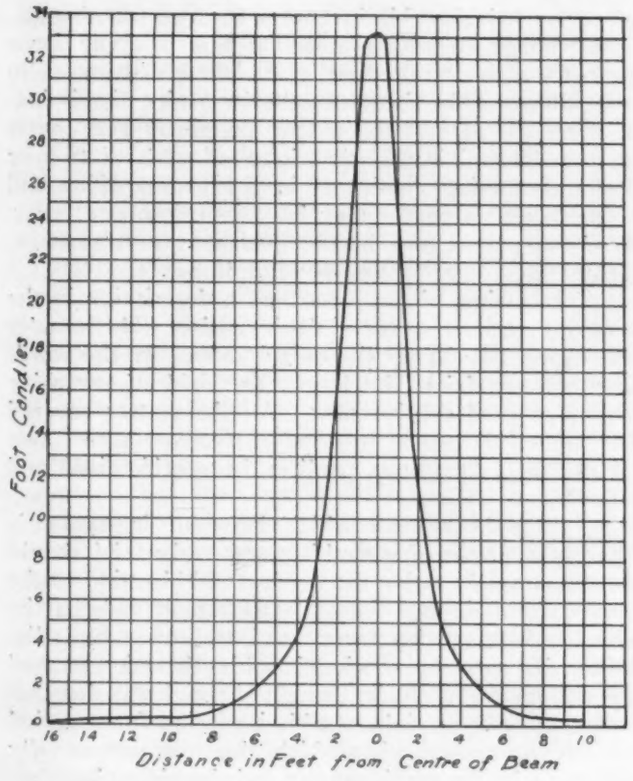


Fig. 4.

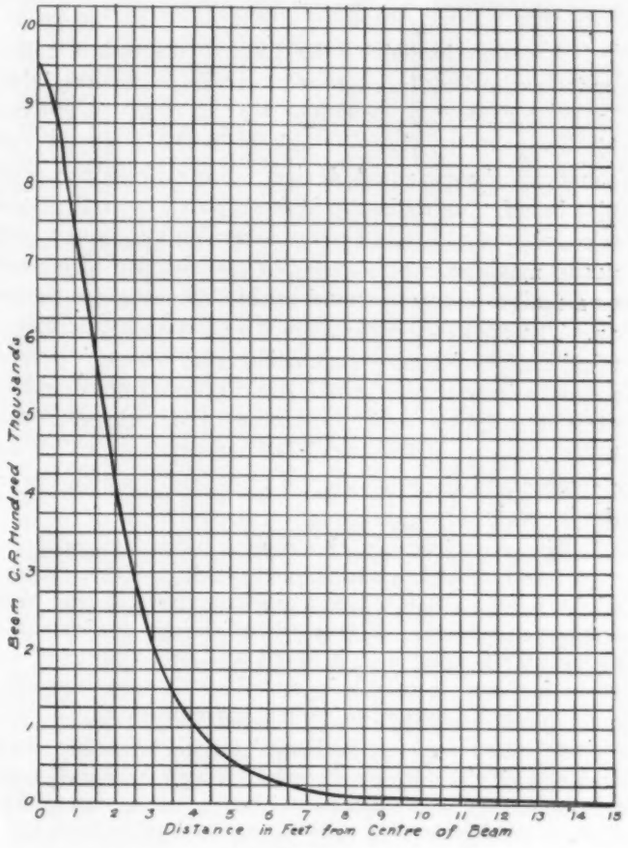


Fig. 5.

Distribution Curves Across Center of Beam at 170 ft. Radius. 6-Volt 151.3 c.p. Single Helix Mazda Lamp in J8 Locomotive Headlight Equipped with 19 5/16 in. Parabolic Reflector of 2¾ in. Focus. Multiplying Factor, 6340.

HOW TO GET A JOB.

BY FRED A DIBBLE.

1. Make a list of the names of the firms for whom you are qualified to work.

2. Write a letter of application stating specifically what you are qualified to do by reason of—

(1) Taste or natural inclination.
(2) Education or general training.
(3) Experience or special training.
(4) Give references as to:
(a) Where you have worked during your working life.
(b) Character references.
(c) Social references.

Spend enough time in preparation of this letter to give your story essentially complete in fewest number of words.

3. Typewrite or have typed for you 1, 5, 10 or 20 copies of this letter each day until you have exhausted your list or have secured your job.

4. Put in the remainder of your time following up these letters and the answers they bring by personal calls. At the end of each interview if your services are not needed, tactfully inquire if the person you are calling upon can suggest anyone who might need your services. Make a careful note of any suggestions or addresses and then follow up these also.

5. Require of yourself that you send out regularly each day the number of letters that you have set as your stint.

6. Advertise:

(1) Place an advertisement in the Situation Wanted Department of the Trade and Class papers touching the field you desire to enter.
(2) Use the daily papers if you can afford it.
(3) Answer ads which seem to fit your qualifications in all these papers.

7. Write to your old employers, frankly stating what you want to do. They may be able to help you with advice and suggestions.

8. Let as many people as possible know what you want to do. Believe all the time that everybody wants you to have a good job.

9. Take especial pains to keep up your personal appearance. Your person and clothes should receive extra care.

10. Keep up your spirits by belief in yourself, and carry an air of optimism and good-will toward everybody. And keep your eyes and ears open and your mind so fully occupied that you will have no time to become discouraged.

PATENTS A PROFITABLE FIELD.

BY GEO. J. HENRY.

(After defining patentability and the procedure in patenting an invention, the author shows the limitations which accompany carelessly drawn claims. Mr. Henry is a consulting engineer at San Francisco now specializing on patent application.—The Editor.)

A patent issued by the United States is a grant under authority of Congress of certain exclusive rights to an inventor in exchange for his fully disclosing his invention so that one skilled in the same art can construct the patented device. Contrary to the popular belief, patents in the United States are not issued to cover everything. They are issued only for a new and useful machine, manufacture or composition of matter or a design or any new and useful improvement thereon. The application consists of a petition to the Commissioner of Patents requesting the issue of letters patent, a specification which consists of a full and complete description with a drawing or drawings of the invention and claims or detail descriptions of those elements and their manner of association which cover the invention.

The examiners in the patent office are experts, each familiar with a particular branch or classification of the patent office records, and they have access to a complete collection of records with the subjects all properly classified and indexed and cross indexed so as to facilitate a search in an effort to determine the novelty of the invention under consideration.

A patent will not be issued for an invention that will not work, nor for one that would be dangerous to the public interests, as neither of these would be useful. Aside from a few limitations of this nature and including also inventions claiming perpetual motion, the question of usefulness is usually left largely to the inventor, his allegation that it is useful being sufficient; the inventor himself being conceded to be a good judge of this.

The determination of whether or not the invention is new is, however, one that cannot so well be determined by the inventor, although he must make oath that he is the inventor and believes it was unknown until his invention. The patent office therefore makes a thorough search in an effort to discover whether or not the invention was previously known and therefore public property—for that which already belongs to the public cannot be withdrawn in favor of an individual.

The search made by the patent office frequently, in fact usually, uncovers a number of previous inventions in foreign countries as well as in the United States patent office which, in a measure, or wholly, anticipate the device covered by an applicant's specification. The applicant then must make it clear wherein his invention is a further new and useful step in the art over the references which the examiner cites against him, and after these anticipating inventions have been explained away to the satisfaction of the patent office, or certain claims withdrawn, or abandoned, the patent will be issued in its restricted form. The applicant may find that all he thought was new and maybe did in reality independently invent, was not new, some or all of it having been previously in public use or fully described in a printed publication more than two years before his application.

The statutes recognize that to bring an invention into a sufficiently developed form to cover by patent requires time and that while an inventor is working at his improvements others may make public his invention. The original inventor is, however, the one to be protected over others. He must exercise diligence in bringing his invention to a perfected state, even though he may not be the first to apply for a patent thereon, or the first to disclose his invention to the public. This of course calls for a nice discrimination on the part of the patent examiners and courts in the determining of the rights of each of two or more conflicting applicants in the patent office and even though a patent may have issued to one party, a second patent may be obtained by the original inventor upon proving priority and diligence.

The claims of the patent are a description in the shortest, clearest words of the invention. The broader the claims, the larger the range covered by the wording of any claim, the larger the field of exclusive rights granted the inventor. All the matter covered by the valid claims must be perfectly clear to one skilled in the art upon reading the specifications and drawings.

The theory upon which the patent is granted is that an inventor of something new and useful should be encouraged to give the products of his mind to the public for their improvement and benefit and that he should therefore be encouraged to invent and disclose, and as compensation for this, there is reserved to him for his exclusive benefit the right to deny all others a right or rights to his invention for a period of seventeen years, after which, the invention as fully disclosed in the specifications and drawings, becomes the property of the public and no further rights are allowed the inventor. This, at first thought, seems rather unfair, but if the inventor has availed himself of the seventeen years protection of his patent, and he has something really new and really useful he may have acquired such a position that competitors can scarcely assail him. Such an example is before us in the telephone interests of the United States—this gigantic industry having been built up largely on patents.

It must be noted that a patent may be primarily considered as granting to the patentee or his assigns the right to deny others the right or rights to his invention. This is most important. It follows that an innocent but original inventor who does not apply promptly for a patent runs the risk of others doing so and receiving a patent under which he may be estopped from the manufacture of devices of which he was the real inventor. It is therefore absolutely necessary especially in a mechanical business to protect each inventive step to prevent others from interfering with the growing business. This course is regularly pursued by the large progressive electrical companies and others who employ experts for the sole purpose of inventing and covering inventions with patents. It will thus be seen that many large business aggregations are protected by the patent law, and it is just this protection that has secured supremacy for American manufacturers.

It is true that there are many patents issued that are of no value and are a source of expense to the inventor instead of profit, but this is not the fault of the law. It is to be assumed that unless the inventor thought he had something worth the investment he would not make the application. A patent may be so restricted in its claims that any one skilled in the art to which it belongs can readily avoid the claims and still use the best part of the inventions, and it is just here that a patent attorney is in a position to be of the greatest service to the inventor. The claims are what really determine what protection is to be afforded the inventor and he is not protected on any thing not set forth in the claims. Patentees sometimes overlook this fact and think they will be protected on the entire device as shown in the drawings. This is not so. For example, an inventor might apply for a patent on a registering and counting device for a printing press and show in the drawings accompanying his application a full printing press with his device thereon but he would be restricted to claims only on the particularly new features. Patentees are frequently disappointed to find the limitations of their patents, and it is to be regretted that there are many patent attorneys who depend on following conventional methods and who are so little posted on mechanics and technical matters generally and thrive at the expense of the inventors who know nothing of the patent office practice.

If an application is drawn broadly and so as to really be of value if the patent issues the broad claims are likely to be rejected on the first action by the patent office, and it then becomes the function of a conscientious attorney to endeavor to bring the examiner to view the rejected broad claims in the light of patentable invention. This frequently takes much time and correspondence but the results always warrant this effort and time and where the inventor is satisfied with the good faith and competence of his attorney, the extent of the patent office rejections and attorney's arguments is no detriment to the patent when issued or to the inventor's rights.

The patent office allows one year for replies and actions on the applicant's part to actions by the office before construing them abandoned, and some attorneys make a practice of waiting almost the entire year, this on the theory that the longer a case is kept in the patent office, the longer will the applicant be allowed protection as the patent grant of seventeen years does not commence to run until the patent issues although the patentee is protected from his date of invention.

It frequently happens that it is an advantage to delay the issue of the patent, and in such cases, this course is admissible. Generic patents in aeronautics would probably net the inventor more if so delayed, as the world has not yet grown up to the state of providing a large absorbing market to make the patent a remunerative one.

If when Father Stonehatchet invented the wagon wheel he had recourse to patent protection, it would have been a great advantage to have delayed the actual issue of his patent until such time as civilization would have found the wheel of great value, as for example, in the conquests of Alexander. This extreme case is cited to show the principle only and also to point that modern civilization is dependent to an enormous extent on discovery followed by invention, for the discovery of the circle and the fact that its center would travel parallel with a straight line on which the circle rolled was a discovery much earlier than its adaptation to a wagon body for simplifying transportation, which adaptation was an inventive act.

In contradistinction to this course, it must be borne in mind that today a generic invention is something extremely rare. The selenium cell for wireless telegraphy is one probably within the memory of most of us, and therefore almost all inventions are of a restricted nature. As a useful art to which an invention belongs becomes more highly developed, there are a greater and greater number of inventions patented, but the extent of the patent or at least, the protection it affords, is of a more and more limited extent and not infrequently the details of any particular device may be changing every few years so that nothing is to be gained by delaying the issue of a patent and the inventors interests demand its issuance at the earliest possible date, such for example, would be a skirt hanger or hat pins, where the mandates of style would otherwise outrun the actions of a slow attorney, and competitors would infringe, collect their profits, disburse their funds, dissolve their organization and start anew before the inventor would receive his patent and have a basis to sue infringers.

The value of good patents is great when properly handled after issue as well as during the application period and the subject is one of profit that many scientific minds are overlooking. In our highly organized civilization, the development of the inventive faculty has brought within the range of usefulness a myriad discoveries that had lain fallow through the centuries before, waiting only the trained inventive eye to pluck them forth and marshal them as the slaves of man in new and useful garb.

Brass and bronze are copper alloys with zinc and tin respectively. When the presence of other metals is to be indicated the names are prefixed to the term as tin-brass, aluminum-brass, or manganese-brass.

Time in repairing troubles on the underground system of the city of Philadelphia has been very much reduced by the use of an electric truck. The number of hours in which the underground circuits were out of service was cut down in 1913 about forty per cent as compared with 1912. The cost of operation in 1913 was a little less than for 1912 even with the greater amount of work. The forces employed were twenty as compared with 21 in 1912.

The "safety first" movement has received impetus at Portland, Oregon, by the organization of a commission consisting of Chief of Police Clark, F. C. Burkhalter, general superintendent of the Southern Pacific Company; B. F. Boynton, chief claim agent of the Portland Railway, Light & Power Company; L. R. Alderman, superintendent of schools; Marshall N. Dana and Harry P. Coffin. An exhibit has been arranged and every effort is to be made to educate the public in the necessity for caution.

JOURNAL OF ELECTRICITY
POWER AND GAS

FOUNDED 1887

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBT. SIBLEY, Treas. and Special Contributor
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

CONTENTS

Key City Light & Power Company 355

A Resume and Comparison of Rate Theories 357
By Stacy Hamilton.

Electrical Resistance Ceases 361

Standards at San Diego 362
By L. M. Klauber

Electric Headlights 363
By A. G. Jones.

How to Get a Job 365
By Fred S. Dibble.

Patents a Profitable Field 366
By Geo. J. Henry.

Editorials 368
Utility Home Rule.
The Court of Appeal.
Destroying Confidence.

Personals 370

Meeting Notices 370

Trade Notes 371

New Catalogues 371

International Electrical Congress Posponed 371

Publications Received 372

Industrial 372
A Mazda Journey.
Miniature Transformer for All-Night Lamps.

News Notes 373

Ruling of the San Francisco Department of Electricity 371

Destroying Confidence

The manner of reorganizing the muddled affairs of the Northern Electric Railway Company will react unfavorably on all utility securities. As the Kaiser characterized a sacred understanding "as only a scrap of paper," so those concerns such as the Peoples Water Company and the Northern Electric Railway Company who are now attempting to evade their responsibilities will create the belief that no obligation is binding.

American municipalities have but recently recovered from the bad name resulting from wholesale repudiation of debts. Any financial offering will be a drug on the market if there is any suspicion that the promoters have any future intention of stepping from under at crucial times.

On the other hand an honest assumption of loss and a determined effort to meet underlying bond issues would excite the admiration of the world and do much to bolster up the waning confidence of the investor in public utility securities.

More need not be said, less could not be said. To elaborate further would be unnecessary to those who can understand it—and useless to those who can not.

The Court of Appeal

The public utilities are beginning to recognize that when governmental bodies deny them a fair hearing, it is always possible to go before the people and tell their story freely, fearlessly and frankly. The latest company to take advantage of this opportunity to present their side of a controversy is the "Key System" which operates a traction service in Alameda county, California.

It seems that this company has outlined an elaborate plan of development intended to adequately care for the increased traffic which is anticipated during the Exposition year. This includes not only the construction of a filled pier, but also new cars and ferry boats, features involving heavy expenditures in these days of financial stringency. Meanwhile the city of Berkeley, one of the municipalities which the company serves, had ordered certain street repaving which would necessitate an expenditure of over one hundred thousand dollars on the part of the traction company. Notwithstanding the fact that the company officials had explained the situation to the city authorities, notice was given that force would be employed to prevent the operation of interurban trains after the first of October, the excuse being that franchises had been granted only for the operation of single cars.

The company met the notice squarely by circulating literature and petitions on their trains and in the homes of commuters. Many patrons protested to the civic authorities against any curtailment in service and as a result what had promised to be a long legal fight was brought to a speedy close by the city consenting to an expenditure of about one-third the orig-

inal demand. This satisfactory outcome was largely due to the company's appeal to public opinion.

It is nearly a hundred years since Emerson wrote "as gas light is found to be the best nocturnal police, so the universe protects itself by pitiless publicity." Like many of the other principles laid down by this master mind the wisdom of applying this fact in every day life is just being recognized.

During the past few months Henry L. Doherty has been conducting a great advertising campaign in Toledo to convince the public of the injustice of a three cent fare. He recognizes that the public is the real umpire and that their good will and confidence is necessary for good utility service.

The value of a favorable public opinion is indicated by the efforts of the several European nations to exonerate themselves in declaring and continuing the present war. Germany is making as strong efforts to cultivate a friendly feeling on the part of the United States. Secrecy is no longer a source of success in either war or business.

The same opportunity for a sympathetic hearing is available to every corporation with a soul, every company which recognizes the public quality of its service. If "big business" has puts its house in order and has a truthful, honest and convincing message, the public is always ready to give a fair hearing. The potency of printer's ink is rigidly dependent upon the merits of the thing advertised.

The most important problem now facing public utility operators is how to improve public relations. If the utility expects an attitude of fairness, frankness and co-operation from the public, it must first assume that attitude toward the public. Confidence can be built only upon the firm foundation of good service, fair treatment and the fullest publicity.

Utility Home Rule

The control of public utilities is now a subject of general interest, particularly in these Western states where the public is being asked to decide the matter at general elections. Without discussing the danger of entrusting such decisions to the average ignorant voter, the fact remains that designing politicians are plotting to keep a hold on the power of making rates in cities. Their plan is not only to rule, but to over-rule the utilities.

In Oregon and Washington, where the state public service commissions have been granted rate-making powers, an effort is being made to take the power away from the commissions. In California the situation is reversed. To insure the enactment of the bill creating the commission, rate-making jurisdiction over utilities in incorporated cities was specifically withheld, except where such cities might vote to surrender those powers. Determined opposition is consequently active to defeat the proposal to extend the commission's jurisdiction over gas and electric utilities in cities.

The strongest argument against state regulation is based upon an appeal to pride in local self-government. It is further contended that rate-making is one of those powers which can be most efficiently exercised by delegating it to some agency directly responsible to those who would be benefitted by having it enforced. While this principle is good political economy for those who might be benefitted, it is equally bad for those who might be harmed. It is predicated upon the thought that regulation is needed only where existing rates are too high. The following quotation from a minority report to the Commonwealth Club of San Francisco is typical of the narrow point-of-view of those favoring municipal control.

It may be that the utility sought to be regulated is one that is operated in one city only, and that it may be in competition with the utility owned by the city. In such a case it seems to me that the city is the best judge of what is a fair and reasonable rate, and at least would not desire to have that question decided by some outside authority.

How fair and reasonable it is for the interested party to determine how much he is to pay for what he buys! It is as natural for the company to want to raise rates as for the citizen to depress them. Some balance must be provided to prevent either of these opposing forces from throwing the whole economic machine out of gear.

The proper equilibrium is being maintained by state commissions who recognize the mutual obligations, that of the company to provide adequate service at reasonable rates, and that of the community to protect the investment against ruinous competition.

A state commission is a continuing body with a steadfast policy and procedure. In this Western territory, where high tension transmission has made hydroelectric power available over wide areas, there are many utilities which supply several large cities. These several cities cannot prescribe as uniform and consistent rates as a commission. Nor can they individually afford the expense of maintaining the high grade technical organization now necessary. Intelligent decision demands expert engineering, accounting and statistical advice. All these facilities are at the command of a state commission at a minimum expense because regularly employed all over the state. A city has no such diversity factor. It can ill afford to maintain a board of public utilities. In fact the money so expended might well be utilized in other necessary public improvements.

Furthermore there have been but comparatively few appeals from the rate decisions of state commissions, whereas the expense of law suits in bolstering up the rulings of city boards is frequently very heavy.

The whole trend of modern economic thought is opposed to political interference with the public service. The politicians are naturally trying to obtain or retain control. So when the question comes to the voter it should be self-evident that both efficiency and justice require that utility rate making powers should be vested in the state commission.

PERSONALS

J. A. Clay, general manager Western Colorado Power Company at Durango, Colo., was a recent visitor at Salt Lake.

P. H. Griffith, chief engineer of the Los Angeles Railway Company, is a recent business visitor in San Francisco.

Elmer Dover, president Western States Gas & Electric Company of Tacoma, Wash., is a recent visitor at San Francisco.

J. T. Reddy of Medford, Ore., who is building an electric railroad in that section of Oregon, arrived in San Francisco last week.

W. T. Kyle, formerly district sales manager for the Duplex Metals Company, has joined the sales force of the Okonite Company at their New York office.

G. A. Sherman, stores manager Western Electric Company, returned to San Francisco from Seattle, where he has been inspecting the warehouses of that company.

W. W. Garthwaite has been named a director in the San Francisco-Oakland Terminal Railways, to take the place of Geo. C. Moore, who recently relinquished control of the road.

F. J. Perrey, formerly salesman Krogh Manufacturing Company, has temporarily re-entered the sales force of the Wagner Electric Manufacturing Company at San Francisco.

W. L. Goodwin, vice-president Pacific States Electric Company, San Francisco, returned recently from a business trip to Los Angeles and throughout the southern part of the State.

F. H. Leggett, Pacific district manager Western Electric Company, and wife, has left for the East where we will visit the factories at Hawthorne, Illinois, and New York. He expects to be gone about three weeks.

Russell Gould has been advanced from superintendent of substations of the Northern Electric Railway, Chico, Cal., to superintendent of power with jurisdiction over the substations, overhead, third-rail and bonding.

H. H. Hatswell, sales engineer, Seattle branch, Charles C. Moore & Company, is visiting the various factories of that company in the East. **Darrah Corbet,** sales engineer of that branch, has recently returned from the same trip.

E. H. LeTourneau, engineer, light and power department, Portland Railway, Light & Power Company, has been appointed secretary of the Northwest Light & Power Association, with offices in the Electric Building, Portland, Oregon.

E. M. Schlessinger, factory superintendent Electric Railway & Manufacturers' Supply Company of San Francisco, recently returned from Fresno, where he inspected the electrical installation of the White Theater and also the Hollenbeck Planing Mills.

H. T. Matthew has resigned as Pacific Coast advertising representative of the McGraw Publishing Company to become general manager of the American Cement Products Company of Los Angeles, manufacturers of concrete lamp standards and poles by the centrifugal process.

Y. Yonezawa, engineer Imperial Japanese department of commerce to America and Europe, will leave San Francisco for the East this week, where he will visit the factories of the Western Electric Company to study telephone and traffic problems and the latest switchboard developments.

W. G. Balph, W. O. Peale, detail and supply department, and **O. B. Stroman,** industrial and power department of the Westinghouse Electric and Manufacturing Company, from East Pittsburg, Pa., are in San Francisco, making their annual tour, visiting the various branches of that company.

W. H. P. Hill, formerly district manager Great Western Power Company, Sacramento, has taken the place of **C. C. Craig,** formerly sales manager Northwestern Electric Company of Portland, Ore., who has become the general sales manager for the Coin Machine Manufacturing Company at San Francisco.

MEETING NOTICES.

Seattle Section, A. I. E. E.

The October meeting of the American Institute of Electrical Engineers will be held on Tuesday evening, October 20th, at the Rathskeller, corner Second avenue and Spring street. Dinner will be served at 7 o'clock. The dinner will be followed by reports on the meetings of the national society held at Detroit in June and of the Pacific Coast meeting held in Spokane in September. The program for the year will be outlined.

Jovian Electrical League of Southern California.

About 125 Jovians and a number of guests attended the weekly luncheon of the League, held at Christopher's, on Wednesday, October 7th. The chairman of the day was Deacon Pyle, who had prepared an enjoyable program in the form of a musical treat by Miss Ruby Miller and addresses by Motley H. Flint, chairman of the Los Angeles Convention Committee, on "What 1915 Means to Los Angeles," and Judge Robert L. Hubbard, on "The Big Brother Movement." Mr. Flint's talk was of an optimistic nature in regard to business conditions and the outlook for 1915. He spoke encouragingly about California's exports, remarking that they had increased at the rate of three millions per week. Already thirty-five large conventions have been scheduled to meet in Los Angeles in 1915 and he advocated the use of the city's prayer, "Give us this day our daily stranger." Judge Hubbard, who for a number of years has been associated with Judge Ben Lindsey in Juvenile Court matters, spoke enthusiastically about the aid given to boys, who are going astray, by the 325,000 Elks in this country. This, he added, is an age of humanity, even among business men, as exemplified by the Jovian Order, and what is needed is sympathetic cooperation among men.

Oregon Society of Engineers.

The second luncheon of the Oregon Society of Engineers was held in the Crystal Dining Room of the Benson Hotel, Monday, October 5th, at 12:10 p. m. The chairman of the day was F. I. Fuller, vice-president Portland Railway, Light & Power Company. The speaker was W. D. Wheelright, who spoke upon his experiences in Europe and the various phases of the war.

His talk embraced the Business Aspect of the War, the education features of the various institutions of Europe, the high state of the municipal governments—as regards cleanliness, and the regulation of public utilities, also the public spirit of the citizens as a class. He also traced the history of the various countries at war in Europe and showed plainly the political means of each, closing with a plea for universal peace.

The regular monthly meeting of the Oregon Society of Engineers was held in room A of the Public Library Building, Thursday evening, October 8th at 8 o'clock p. m.

Mr. Chas. E. Warner, consulting engineer, was the speaker of the evening and his subject was "Some Hitherto Monumental Features of the Los Angeles Aqueduct."

Having been chairman of the Los Angeles Aqueduct Investigating Board, Mr. Warner is in possession of much interesting information and data. He pointed out that "wholesale graft" appeared in nearly every department connected with the construction of this project.

The society adopted an official pin and emblem, also authorized the sale of the pins to members. It was arranged

that one Sunday a month would be devoted to trips by those members so desiring, to points of engineering interest. These excursions are to be informal; old clothes will be appropriate and lunch baskets.

Joint Meeting of the A. I. E. E. and the N. E. L. A., Portland, Oregon.

About 150 members and guests of the two societies assembled in Portland at 5:30 p. m. and were taken by automobiles to the Portland Automobile Club, situated on the Sandy River, about 25 miles from Portland. Here they were greeted by some fine musical selections rendered by the "Electric Orchestra" of the Portland Railway, Light & Power Company. Also a fine banquet had been prepared and no time was lost in "getting busy" as every one had an appetite after the fine ride.

Mr. Barker of the General Electric Company acted as chairman and toastmaster. Mr. C. N. McArthur, Republican candidate for Congress, made a short non-political address.

Messrs. West, Moody and Merwin appeared in several "stunts" representing a disgruntled farmer who had bought a motor and received 2-ply juice instead of 3-ply.

Franklin P. Griffith, president of the Portland Railway, Light & Power Company, gave a short address in which he said that he thought that of all the societies which went to make up the activities of the Portland Railway, Light & Power Company, that no societies stood higher in his estimation than the N. E. L. A., the A. I. E. E. and the N. W. P. A. He could see great good for the electrical industry by this intermingling of the men engaged in the electrical business. He also felt that "politics" should not be "tabooed" from these societies, because if politics are to have the "stigma" removed from them, they must have the best thought devoted to them, and that business and politics are really one and the same thing. Also if public officers are to use the "horse sense" that is demanded in private business, it is up to the public to demand same. He also spoke of the need of more development of agricultural enterprises.

The members returned to Portland by automobiles and all were unanimous in their hearty appreciation of the efforts of the entertainment committee for making it possible to have such a pleasant and profitable evening. The enthusiasm aroused will undoubtedly make this year a "banner" year for all the associations.

TRADE NOTES.

A commendable start is being made this year to advertise the week from October 19-24 as "Lighting Week." This can be made a co-operative affair and ties in well with the "Edison Day" celebration.

The Fourth and Fifth Street District Improvement Club, San Francisco, has just placed an order for 95 single light electroliers to be installed on Fourth street from Market to Townsend street. These electroliers are of an original design and will be lighted with nitrogen lamps. The installation was designed by Charles T. Phillips, consulting engineer, San Francisco, who will also have charge of the installation.

NEW CATALOGUES.

Duncan Electric Manufacturing Company of Lafayette, Ind., are distributing an interesting bulletin on Duncan Watthour Meters for Switchboard Service. Illustrations and descriptions are given on both a.c. and d.c. meters.

The Edison Business Builder for October from the Edison Lamp Works of General Electric Company, contains a wealth of suggestive and helpful matter for increasing the sale of Mazda lamps, particularly in connection with the celebration of Edison Day on October 21.

The Western Electric Company, 463 West street, New York, are distributing a new mailing folder, entitled "Profitable Electrical Merchandise." This catalogs the complete line of dealers' helps which this company offers to the electrical trade to assist it in the sale of washing machines and vacuum cleaners.

INTERNATIONAL ELECTRICAL CONGRESS POSTPONED.

On October 9th the board of directors of the American Institute of Electrical Engineers approved the recommendation of the executive committee of the International Electrical Congress that the Congress be indefinitely postponed because of the disruption of plans by the European war.

Favorable consideration was given to the recommendation that the regular annual Institute convention be held at San Francisco in lieu of the Congress, the date being the only matter of doubt. In order to decide this matter the meetings committee was instructed to canvass the officers of the Pacific Coast Sections as to whether they preferred having the regular annual convention in June or a special meeting in April.

H. A. Lardner, chairman of the committee on Pacific Coast relations for the Congress, has secured accommodations in the municipal auditorium for the week of September 13th, the original date for the Congress, and the week of June 14th, following the annual convention of the National Electric Light Association.

The Institute board has decided that it would not be expedient to accept the courteous suggestion of Chairman Durand that the International Electrical Congress be merged with the International Engineering Congress.

RULING OF SAN FRANCISCO DEPARTMENT OF ELECTRICITY.

James M. Barry, chief of the San Francisco Department of Electricity, has recently issued the following rulings on construction details.

The Department of Electricity will approve the temporary installation of electric motors when installed under the following conditions:

Motor must be protected by approved switch and cutout installed in such a manner that workmen and passers-by cannot come in accidental contact with same. A metal or wooden box for switch and fuses is recommended.

Current carrying wires to motors must be approved rubber insulated double braid wires supported on knobs or installed in conduit and, if on knobs, must be suitably protected at all points where accidental contact is possible by substantial wooden boxing, and, in any case, shall be so protected to a height of 8 ft. 0 in. above the ground. In very hazardous installations, wooden boxing will not be accepted in lieu of conduit.

Motor frame must be grounded. If no good ground is available, a 1½ in. pipe driven into the earth to a depth of 5 feet will be considered a suitable ground. Wire to ground must be equal in size and conductivity to No. 10 B. & S. G. copper.

On temporary motor installations, the Department of Electricity will approve the use of rubber-insulated new code wire with the current carrying values given in Table B, Section 18 of the National Electrical Code. Common return wire on 3-wire two-phase motors shall be figured to carry a current 41 per cent greater than the other two legs.

The above ruling supersedes the ruling of the department on temporary motor installations under date of January 13, 1914, and is revocable at any time on due notice.

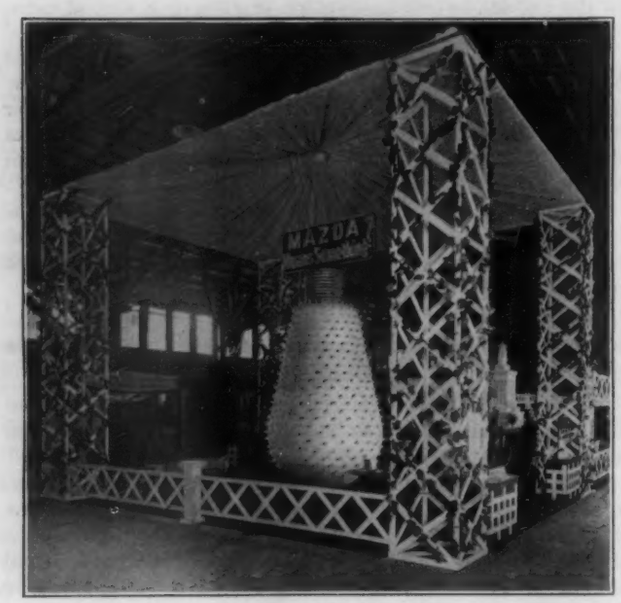
On exposed ends of conduits back of switchboards where it is necessary to cable wires together, in order to do a workmanlike job, approved porcelain bushed iron bushings will be accepted in lieu of condulets. Hereafter, plain iron bushings will not be accepted on exposed ends of conduit back of switchboards.

INDUSTRIAL

A MAZDA JOURNEY.

Last week a number of live wires in the region of San Francisco Bay, where the electrical variety thrive to perfection, were personally conducted on a journey through Alameda county in order to find out what Mazda means. H. H. Cudmore, director of the Mazda Bureau of the General Electric Company, was the personal conductor.

Like all properly regulated journeys the trip was not taken until after the needs of the inner man had been fully cared for by a sumptuous lunch at the Hotel Oakland. If the needs of the lamp consumer are as well anticipated as were those of the luncheon guests, Mazda is certainly synonymous



Mazda Exhibit.

with service. Nor did Mr. Cudmore serv (e) ice with his enthusiasm in telling what had been accomplished by the "Mazda Bees" during the past month in letting the public know that "Mazda means something."

Waiting automobiles whisked the party in a brief circuit of a few of the forty-five electrical stores in Oakland which carried window displays of the slogan and service. This business joy ride to give the "up-and-down" over Mazda window displays, bill-boards and newspaper advertisements terminated at the Alameda County Exhibition and Carnival at Idora Park.

Here the Mazda exhibit, as shown herewith, was given the "once-over" and opportunity afforded to visit other electrical displays at the fair. The Mazda exhibit, however, was the central attraction, the observed of all observers, the cynosure of all eyes.

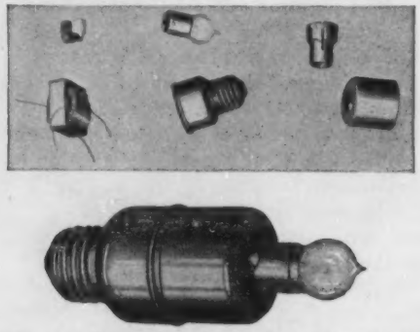
Those who were fortunate enough to be invited in this little journey of observation of Mazda co-operation with distributers were as follows:

W. W. Goodwin, Pacific States Electric Co.
Col. H. V. Carter, Pacific States Electric Co.
D. E. Harris, Pacific States Electric Co.
W. W. Briggs, Great Western Power Co.
F. H. Woodward, Great Western Power Co.
M. Burton, Westinghouse Lamp Co.
C. Heise, Westinghouse Elect. & Mfg. Co.
R. D. Holabird, Holabird-Reynolds Co.
C. C. Hillis, Electric Appliance Co.
F. J. Cram, Electric Appliance Co.
W. L. Berry, Western Electric Co.
F. H. Leggett, Western Electric Co.
M. A. Bryte, Sterling Division National Lamp Works of General Electric Co., Mission St.
A. H. Coates, Colonial Agency Co.
Chas. Wiggins, Dunham, Carrigan & Hayden.
C. I. McColgan, Columbia Division National Lamp Works of General Electric Co.
E. B. Strong, Journal of Electricity, Power and Gas.
A. H. Halloran, Journal of Electricity, Power and Gas.
F. D. Fagan, General Electric Co.
P. A. Vandegrift, Oakland Mazda Lamp Division National Lamp Works of General Electric Co.
Albert H. Elliott, attorney for Jobbers' Association.
T. E. Bibbins, General Electric Co.
Mr. Welling, Federal Sign System (Electric).
Andrew Carrigan, Dunham, Carrigan & Hayden Co.
Dr. T. A. Addison, General Electric Co.
Mr. Landry, Dunham, Carrigan & Hayden.
W. F. Boardman, W. F. Boardman Co.
Mr. Eckert, W. F. Boardman Co.
John Britton, Pacific Gas & Electric Co.
Geo. C. Holberton, Pacific Gas & Electric Co.
Mr. Furness, Pacific Gas & Electric Co.
F. A. Leach, Pacific Gas & Electric Co.
Frank Fowden, Brooks, Follis Elec. Co.

MINIATURE TRANSFORMER FOR ALL-NIGHT LAMPS.

The inability to turn down an electric lamp has been a great inconvenience to those who desire a low burning lamp for all night service. The demand for an electric light which could be burned all night without too much light and too great a cost for current has created several types of all night electric lamps of which the Nite Lite transformer lamp, produced by the General Electric Company, is the latest.

The device consists of a miniature transformer contained in a polished brass shell, and a miniature Mazda lamp. It operates on any alternating current supply circuit ranging



Miniature Transformer for All-Night Lamps.

in voltage from one hundred to one hundred and twenty-five, and in frequency from fifty to one hundred and forty cycles. It is installed by simply screwing it into the standard lamp socket in place of the usual incandescent lamp.

The transformer, although miniature in design, is constructed with liberally insulated primary and secondary coils, and with a core built of the highest grade of transformer steel punchings. Its function is to transform the normal supply voltage to about six or seven volts before it is supplied to the lamp. The receptacle for the lamp is designed to fit a rear and speedmeter Mazda automobile lamp, 2 c.p., 6 and 7 volts, 1.25 w.p.c., G-6 bulb with bayonet base.

The cost of operating this device continually is very little. At the average cost of electricity, a Nite Lite transformer will burn for ten hours at a total cost of less than four-tenths of a cent. The device is especially adapted to the illumination of door numbers, sick rooms, nurseries, bath rooms, closets, etc.

PUBLICATIONS RECEIVED.

Factors Governing the Combustion of Coal in Boiler Furnaces is the subject of a preliminary report from the U. S. Bureau of Mines by J. K. Clement and J. C. W. Frazer.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The Municipal Railway bond fund is insufficient for the construction of the new lines for which is was voted, according to a report by Leonard Leavy, bookkeeper of the Public Works Board. The deficit is attributed to the extra cost of the cable system for the Church street hill, which the supervisors lately ordered. The bonds of the issue of $3,500,000 that have been sold amount to $2,642,500. They brought a premium of $23,658. Whether the remaining $857,000 can be sold now is considered doubtful because of market conditions. For work already undertaken $1,915,567 has been expended. For final payments on contracts and finishing the present work, $718,226 is required. For new work, the city engineer's estimate is $1,020,240, making a total of $3,654,033. If the remaining bonds are sold the available cash will total $3,523,658, leaving a deficit of $130,374. This may be reduced by $39,005 if the following refunds are received: From the Ocean Shore Railroad, $34,676; from the Western Pacific $1467; from the street lighting fund, on account of Van Ness avenue lights, $2861. The city engineer's estimate for new work includes these items: California street line, $127,500; reconstruction of Union street line, $49,000; Potrero car barn, $211,325; work cars and tower wagons, $10,000; Church street line, with cable, $433,000; machine shop equipment, $6500; plans and inspection, $54,000 additional; freight on cars, etc., $44,065, in addition to $137,000 already appropriated; track specials, $22,486; trolley poles, $9883; completion of Van Ness and Chestnut street construction, $8861.

ILLUMINATION.

PORT ANGELES, WASH.—A number of light extensions will soon be made.

LAGUNA BEACH, CAL.—Several parties are considering putting in a local electric light plant at once.

BILLINGS, MONT.—W. B. Snyder, general manager, states that the Billings Gas Company will erect a 200,000 cu. ft. capacity holder in the spring.

VICTOR, IDAHO.—A special election has been called for October 24 to vote on the question of $3500 bonds for the construction of an electrical distribution plant.

PASADENA, CAL.—The city trustees of South Pasadena have advertised for bids for lighting Fair Oaks avenue, to Alhambra road, where it joins the county boulevard.

PASADENA, CAL.—H. C. Deming is interviewing property owners fronting on South Marengo avenue relative to the installation of an ornamental street lighting system.

GLENDALE, CAL.—The Pacific Light & Power Company has bid on ornamental light posts and current for lighting Brand boulevard. The bid calls for 81 metal posts with appliances.

PORTLAND, ORE.—Permission has been granted by the county commissioners to property owners and business men for a system of bracket lights on Fourth street from Yamhill to Burnside.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county, Cal., will receive bids until October 19th for furnishing electricity and maintaining lights in the Burleigh lighting district.

ALAMEDA, CAL.—The city council has agreed to reduce the commercial lighting and power rates from 7c to 5c per 1000 kw. respectively to 5c and 3c. The council also decided to extend the lines of the local electric plant to Bay Farm Island.

PORTLAND, ORE.—Property owners and business men on Fourth street have been granted permission by the city commission to install a system of street bracket lights. As soon as plans can be made work will begin.

WINNEMUCCA, NEV.—The possibility of gas service in Winnemucca is indicated by a petition to the county commissioners to grant a franchise for gas mains to W. J. Compton and Frank L. Reber for a 20-year period.

ANAHEIM, CAL.—Preparations are being made for the installation of an ornamental lighting system in Anaheim. Sample cluster lights will be installed at the corner of Center and Los Angeles streets as soon as possible, and if satisfactory, additional lights will be installed.

SPOKANE, WASH.—J. D. Isaacs, Jr., resident engineer in charge of terminal work for the O-W. R. & N. and the C. M. & St. P., has presented details of plans for lighting street areas under the elevated structures of the railroad companies to Commissioner McBroom.

WOODLAND, CAL.—Plans are being formulated by the officials of the Pacific Gas & Electric Company to improve the gas service in Woodland. The project is to either construct a new plant altogether or lay a pipe line from Sacramento and discontinue the making of gas here. Which ever plan is put into effect it necessitates an outlay of between $40,000 and $50,000.

REDLANDS, CAL.—A contract has been signed by the city board of trustees with the Edison company for street lighting for 5 years. There had been some talk of a municipal plant, but that plan was laid over in view of the contract submitted by the Edison Company. Under the contract, all incandescent street lighting will be Mazda lamps of 32 candle power, replacing the present 16 candle power lamp.

TRANSMISSION.

NOGALES, ARIZ.—The International Gas Company is constructing a modern electric light and power plant here. Power will be furnished in adjacent territory.

EXETER, CAL.—The Tulare Power Company has been granted permission to erect an 11,000 volt distribution line from the northwest corner of Chestnut and F streets north on F street.

LOMPOC, CAL.—The city trustees have granted a permit to the Kieselguhr Company to build a power line from their plant to the city limits to connect with the line of the Midland Counties Public Service Corporation.

LEWISTON, IDAHO.—R. C. Dahlheim and associates will ask for franchises for an electric railway in Clarkston and Lewiston. Option is held on the property of the Lewiston Terminal Company calling for the completion of the road before 1916.

POCATELLO, IDAHO.—As a result of a recent storm when lightning wrecked the substation of the Southern Idaho Water Power Company at Ross Fork, considerable improvement will have to be done at that point. Two transformers were burned out, and the building was burned down.

FALLON, NEV.—The Nevada Valleys Power Company, successful bidder for the power output of the Lahontan dam of the Government Irrigation Project, is purchasing supplies and preparing to start work on a power line 82 miles long, from Lahonton to Hazen, Hazen to Lovelock and Lovelock to Orlena and Rochester. A 60,000 volt line will transmit power for use in irrigation by pumping and for use in the new mills being constructed at Rochester. The company has filed a cash bond of $25,000 with the government.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The supervisors' finance committee has agreed to accept from the United Railroads $44,379, which the company figured was the franchise percentage due the city for the year 1913.

OAKLAND, CAL.—Petitions signed by 7500 persons requesting that permission be given for the continuation of Key Route trains from Twelfth and Poplar streets along Twelfth street to Broadway, have been filed with the city council.

BENICIA, CAL.—The city trustees have granted to A. D. Bowen an electric railroad franchise over the streets of the city to the city limits on the Vallejo side. The projected line will connect Benicia and Vallejo. A line to Winters is also proposed.

SAN FRANCISCO, CAL.—The city attorney has advised the board of public words that the United Railroads' franchise on O'Farrell street allows either a single or double track, and the company can be compelled to pave only its single track roadway. This it has done.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has been granted until May, 1915, to complete the extension of the Riverside road line by the city commission. Manager C. W. McKillip said his company had been unable to get the data on the grade owing to the building of the levee in that district until the present and wanted an extension of time until after the rainy season.

BERKELEY, CAL.—The threatened cessation of operation of Key Route trains in Berkeley was bridged over at a conference in the city hall of Berkeley between Mayor Charles D. Heywood, members of the city council and President G. K. Weeks, Director W. I. Brobeck and General Manager W. R. Alberger of the San Francisco-Oakland Terminal Railways. The latter officials agreed to make immediate street improvements at an expense of $37,000 and devote the first money earned by the traction system to permanent improvements in Berkeley.

TELEPHONE AND TELEGRAPH.

DINUBA, CAL.—At a recent session of the city board of trustees, arrangements were made for the purchase and installation of a new fire alarm system.

STOCKTON, CAL.—The city council has passed an ordinance prohibiting the Pacific Telephone & Telegraph Company from exacting a $5 deposit from prospective subscribers as a prerequisite to the installation of a phone.

NELSON, B. C.—Work will start at once on the construction of the dominion government telephone lines. W. H. Stevens, Kamloops, B. C., superintendent of the dominion telephone and telegraph construction in British Columbia.

RED BLUFF, CAL.—At a meeting of the stockholders of the Tehama County Telephone Company the proposition of selling to a newly organized company was discussed. It appears that a new company desires to purchase the plants of the independent companies and Pacific Telephone & Telegraph Company in Tehama and Colusa counties.

ALAMEDA, CAL.—The city council has agreed to give the Pacific States Telephone & Telegraph Company a franchise for 41 years, in exchange for 2 per cent of the gross receipts, 35 free telephones, the use of the company's poles for municipal electric wires, the amount of the cost of the telephones since the former franchise expired and also 2 per cent of the gross receipts since the old franchise expired.

SAN FRANCISCO, CAL.—Jesse W. Lilienthal of the United Railroads and John A. Britton of the Pacific Gas & Electric Company spoke at the convention of the American Railway Association. The three advocated the gaining of the public confidence by public utilities companies as the surest way to success. "The public confidence can only be gained," said Britton, in part, "by the kind of treatment that a reasonable person demands of another in the ordinary walks of life."

WATERWORKS.

SUNNYVALE, CAL.—The city clerk has been instructed to advertise for bids for a water works plant.

RED BLUFF, CAL.—A petition has been received asking that the town provide for a new water system at a cost of $85,000.

LEWISTON, IDAHO.—Contractors Charles Hahn, Crane & Company have been awarded the contract for supplies for the water department.

POCATELLO, IDAHO.—The Short Line is preparing to improve its water system, or that portion of it leading from the city creek. The old wooden pipes will be replaced with iron ones, some of which are already on the ground.

EL PASO, TEXAS.—The city council has awarded the contract to the Fulton Iron Works of St. Louis, to install additional machinery at the city water plant. This firm will furnish an oil engine, pump and air compressor. The cost will be about $44,700.

SPOKANE, WASH.—The raising and diversion of three of the city's big water mains, which now cross Division and Sprague streets, and the protection of two others branching south from Division is one of the tasks connected with the grade separation work.

EL CENTRO, CAL.—H. W. Blaisdell of Blaisdell Filtration Company of Los Angeles, is conferring with the city trustees relative to the installation of a filtration plant here. Blaisdell estimates the cost at about $25,000 to remodel the present city plant and install a new filtration system to furnish 2,000,000 gallons daily.

SAN FRANCISCO, CAL.—By a vote of 13 to 5 the supervisors have decided to submit the proposal to buy the Spring Valley Water Company's properties at $34,500,000 to a vote of the people. The report of the advisory water committee, of which Chief Justice Sullivan is chairman, was indorsed in its entirety, and the city attorney was directed to draw up the proper resolution calling an election of the people to vote upon the question.

LOS ANGELES, CAL.—Chief Engineer Mulholland has presented to the Public Service Commission the map of the proposed Chatsworth reservoir, which it is intended to construct so as to conserve the full supply of the aqueduct and provide a constant source of water for the power project. There are only three land holders to be dealt with in securing the land desired, and Mr. Mulholland stated that he has assurances that the rights of way can be secured for almost nothing. The board formally approved his report and authorized him to proceed to acquire the necessary lands and to advance the plans for the project. About nine miles of rights of way will have to be secured.

SACRAMENTO, CAL.—An expenditure of $5,941,300 is being undertaken by seven companies to divert water from the streams of California, according to the report by the State Water Commission. The report includes matters brought before the commission between March 23, 1912, and April 1, 1914. A total of 38 applications asking permission to divert State waters, were presented, of which 21 were rejected and 11 granted. Four were later revoked because of failure either to comply with the provisions or because of request from the companies. Following is a list of the pending undertakings: Murray & Fletcher, Boulder Creek, $75,000, cost of works; Yolo Water & Power Company, Clear Lake and Cache Creek, $5,185,000; Salve Olsen, North Fork of Feather, $7500; J. F. Thompson, Volcano Canyon, $4000; C. E. Loose, East Walker, $422,302; Birchville Mining Company, Weaver Lake, $30,000; R. G. Gillespie, North Yuba River, $18,500.